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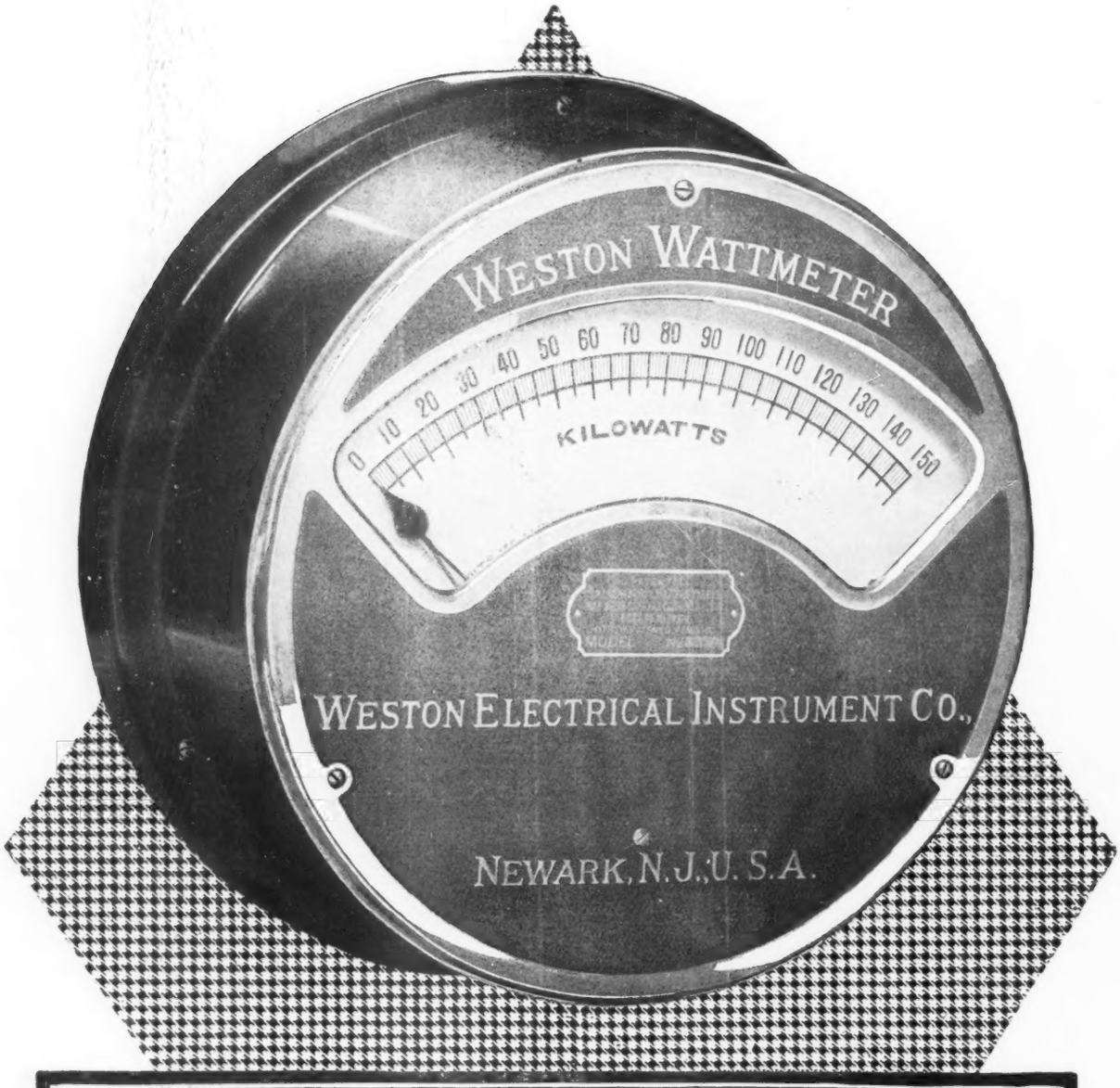
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Growth of the Central-Station Industry

AN INCOME of more than half a billion for 1917, which represents an increase of 200 per cent in a decade, is a performance very creditable to the electric light and power industry of the United States. The census reports show that, roughly speaking, the output doubles itself every five years, and that this is largely made up of industrial load is evident from the fact that the growth in output for the decade was more than 333 per cent. The number of municipal stations has increased within the last five years almost 50 per cent, whereas the number of private stations has increased only 15 per cent; but the drift toward larger stations and greater transmission networks naturally will result in fewer private stations and these will continue to turn out the great bulk of the energy used in the country. The question arises whether the lighting industry can keep up the performance and have to its credit in 1922 an output of 50,000,000,000 kw.-hr. More than that amount can be absorbed in that time if the same impetuous spirit which has thus far spurred the central stations onward prevails. The saturation point is nowhere in sight. Greater industrial expansion must ensue in this country because the immense war debts must be paid. This means greater use of electricity in industry. As for domestic use, the surface has barely been scratched, for out of a total income of $526,000,000,000 probably less than 2 per cent was derived from the sale of appliances. It is impossible to foresee at this time any diminution in the rate of increase of electrical output. During the present period of uncertainty and doubt this rate of increase, of course, does not obtain, but as soon as normal conditions again prevail the growth should be greatly accelerated. The prospects are exceedingly bright, and never in the history of the industry were there greater opportunities.

Hydroelectric plants require the same scrutiny of operating characteristics as steam stations. Water is now far too valuable to be wasted, and if it is to be used to its fullest economic advantage, waterwheels cannot be left to look after themselves.

Engineers in Civic Affairs

APPARENTLY there is a desire on the part of some engineers to become greater factors in the settlement of public questions which have been considered beyond the scope of the profession. This is a laudable purpose; but if the engineer has not heretofore had proper consideration in the discussion of public administration and policies not involving engineering, is it not because he has not consistently interested himself in such problems and has not exerted himself to serve in a political capacity? That can all be changed; but it will depend entirely on whether the engineer will act. Citizenship carries with it certain obligations, not the least of which is responsibility for full political functioning. Sociological problems are among the most salient to be solved at this time, and the engineer can render great public service by directing his logical, analytical mind to conditions for which visionaries are suggesting dangerous panaceas.

The author of the resolution by which the telegraph and telephone lines were seized by the government laments the fact that rates have been increased thereby and apologizes for government control. This, he says, "means the death knell of government ownership of telephone, telegraph or railroad lines." Hindsight, hindsight, but never foresight!

One Engineering Feat Accomplished During War

NITRATE power plant No. 2, which is described in this issue, serves the largest single industrial-plant load in the world. More significant still is the fact that its average load will be greater than Brooklyn's peak load was in 1917. Despite the limited period in which the plant had to be built and the difficulty of securing equipment, reliability of service and economy of operation were not overlooked. In fact, it bids fair to be one of the most economical stations so far erected.

It is situated in a ravine near the level of the Tennessee River as near high-water level as safety permitted, a precaution doubly necessary since a very large amount of water is required for the processes as well as for the boilers. Owing to this location the coal comes in by rail high above the boiler room and is fed by gravity to the crushers. One of the minor puzzles which had to be faced in the station design was some uncertainty as to just what type of coal would, at least for the time being, be available for the stations, and extra boiler capacity had to be allowed on this account. The boilers themselves offered another problem. The Emergency Fleet Corporation with its huge demand for boilers automatically eliminated certain types from the possibilities, but eventually a standard water-tube boiler of 1500 hp. nominal rating was selected as the unit, built for 275 lb. pressure and with provision for 200 per cent of superheat. These figures represent a very material advance over ordinary practice, made necessary because of the high economy which must be maintained for commercial operation of the system after the war. All these boilers were equipped with underfeed stokers, with sufficient capacity to force the boilers to 250 or 300 per cent of their rating when

necessary. The immediate necessities of the plant, bearing in mind the power to be obtained by transmission, were met by laying hands upon a 60,000-kw. turbo-generator already under order by a central station. It is a rather interesting machine, as being of three-unit type, with one high-pressure and two low-pressure elements, each driving its own generator but all tied together electrically, any one of the three units being available independently when necessary. Two additional 30,000-kw. units are included in the final project. All auxiliaries in the plant except the boiler-feed pumps are electrically driven, the power for the purpose being generated by a pair of independent turbines. The electric furnace load to be handled is a singularly steady one, and it is believed that, operating as it will at somewhere nearly 90 per cent load factor, the plant will develop power at an extraordinary high efficiency.

Bureaucracy is not entirely symptomatic of public ownership. It also exists in private ownership and can be detected in every do-nothing organization. Just because of this many communities have turned to government ownership, feeling that they could not fare worse. The want of initiative and imagination in any business eventually leads it to the scrap heap.

Keep Coal Cost in the Rates

COST of fuel in the operation of steam plants of central-station companies will have to be taken into specific account in rate making for an indefinite future period by all properties which do not own their sources of fuel supply. It was as a war-time expedient that the companies introduced coal clauses in their power contracts. This means of protecting themselves against heavy increase in cost found ready approval from the regulating commissions, and its justice was recognized by consumers. It simply included abnormal fuel cost in the price paid by the consumer in a way which stamped that as a fluctuating element in total cost. The fluctuation was upward, but companies as well as consumers felt that the rapid advance might be succeeded by reaction when the war-stimulated demand for fuel should be over. It is safe to assume that there will be some fluctuation in coal cost, as in other raw material costs, before anything like steadiness is reached; but it would be most decidedly unsafe to assume that coal will return to the old low levels.

One central-station executive whose policy has been notably successful held that much coal was sold below cost in pre-war days. It was his conclusion that eventually coal would be unobtainable except at fair cost figures. His individual station needs were safeguarded by the purchase of coal-mining properties. Not only did the subsequent events bear out the accuracy and wisdom of this forecast but there are in addition other elements which complicate the question of coal price level. That is to say, not only have the great body of owners of coal mines learned to put a higher value on the product as they liquidate the assets, but the labor required has also demanded and obtained an increased return for its service. And to the increase in wages of labor at the mine there are added advances in transportation rates and wages, and in all other costs of handling the fuel from the seam in the ground to the stoker in the power plant. There is no assurance that these costs will be any less, there is undoubted possibility that they will tend to still higher levels. They are so plainly a part of the expense of furnishing energy that the central stations cannot afford not to keep them permanently as a variable factor in their rates.

Margin of profit for a central station on a contract for a large block of power is small. It is in fact kept slender by actual or potential competition. And even slight change in the figures which aggregate the basis of the rate to the consumer may mean the difference between profit and loss. Therefore it will be well for the companies to watch with the greatest care all other cost fluctuations which affect operating expense. Following an example already set, it may be advisable for some of the properties to introduce labor clauses similar to coal clauses. But if there is reasonable stability in labor cost it will be simpler on the whole to avoid the addition of variables affecting rates too frequently. However, it will be expensive to fail to check and recheck continually rates and basic costs in any future conditions where fluctuations or sharp advances affect final results in substantial degree.

The general public does not take kindly to higher rates, yet a way in which to keep down the rates is to have fewer and larger generating systems and actual coöperation through interconnection and interchange of energy for the good of all. Material savings are thereby possible, and yet there are those who cannot see the advantages of such action.

Working Hydroelectric Plants

ALMOST every hydroelectric plant has some idiosyncrasies of its own which require rather close investigation if the very best operation of which the plant is capable is to be attained. Some very practical suggestions by L. W. Wyss in another column give important hints as to things for which the operator should be steadily on the lookout. Wherever steam and hydraulic plants are working together, as is now the rule rather than the exception, all the output which can be wrung from the latter relieves the former of its unpleasant burden of fuel consumption. The charge against the water-power plant is mainly overhead, and the more fully it can be loaded the better from the standpoint of economy. One of the very practical considerations taken up by Mr. Wyss is the proper treatment of excess water. Of course, in so far as possible this should be stored against the period when the water supply slackens, but there is a limit beyond which storage cannot go, either with regard to the practical safety of the dam or flashboards or because of the flowage rights above and below the plant. If water has to go to waste, it may or may not be a matter of indifference as to when and how this wastage takes place.

The case Mr. Wyss considers is the not uncommon one in which high tailwater proves more of a nuisance than lowered head above the dam. Backing up of water in the tailrace is a very common occurrence, particularly when everything is wide open in an effort to utilize as much water as possible, and if this condition develops it is a case either for getting after the tailrace or, if this is temporarily impracticable, working the plant just up to the point where the loss from back water overbalances the gain from sending more water through the wheels, as it sometimes does, particularly when it

begins to be difficult to keep up the speed at the reduced head. To keep the tailrace clear and store all you can above the dam are the two maxims always to be kept in mind. Another very practical point raised is the effect of power factor. When this falls considerably the generators may reach their heating limit of capacity before the wheels are overloaded, in which case remedial measures directed at the power factor are imperative. In the case considered by Mr. Wyss it was impossible to operate the waterwheels at their maximum capacity and hence utilize the flood water, because the power factor was low. To remedy the situation the generators in the auxiliary steam plant were overexcited to improve the power factor; this was feasible because they were underloaded anyway and could safely carry some additional wattless current. In this way extra power was developed without any expenditure except for coal to overset the loss in the steam-driven generators due to increased wattless currents.

The operation of hydroelectric plants is full of situations like this, where the operator has to do, not the thing which he would wish to if he were redesigning the plant, but that which can be done on short notice to relieve an awkward situation. Leaks in the dam, too, are ever-present possibilities in most small plants. When a plant is afflicted with bad low-water conditions leakage, under ordinary circumstances an insignificant matter, may amount to a very perceptible fraction of the whole available output, particularly when considered with reference to storing water, and stopping leakage may save greatly at the coal pile. A little study of the water that gets by when the gates are shut down is sometimes an eye opener.

No commission really fulfills its obligations to the legislature which created it unless it interprets the desire of that legislature and the will of the people to the utilities which it regulates. Few commissions recognize this duty, and as a consequence many public utilities are kept in the dark as regards the state of public opinion.

Economic Use of Static Condensers

WHEN a system of alternating-current power transmission or distribution is affected by a low power factor, the delivery of current over the system per kilowatt-hour of delivered energy is necessarily increased. Thus, if power is being delivered electrically to a factory by three-phase conductors, at a delivery pressure of 1 kv. to neutral on each wire, if the power factor is unity, or 100 per cent, each ampere of current in a line will deliver 1 kw. of active power. If, however, the power factor of the factory load falls to 50 per cent, which may easily happen with underloaded induction motors, it will take 2 amp. on the line to deliver 1 kw. This doubled current will fill up the generator, the line wires and the transformers. If the whole distribution system has this power factor, the operating expense may be greatly increased, partly by having to operate more generators than should be necessary for the kilowatt load to be carried and partly by increase in the cost of conductors which may have to be installed in order to carry the increased current with the proper drop of pressure, and so as to avoid the dissatisfaction caused by poor regulation of pressure at customers' premises.

There is only one known remedy for a low power factor, once it has become established, and that is to install either synchronous or static condensers. In either case the procedure involves expense. A synchronous condenser is a particular type of synchronous motor designed so as to be able to run with overexcited field magnets, thereby forcing it to supply condensively reactive power, compensating and annulling the inductively reactive power of the motors on the system. A static condenser is a stationary apparatus which produces the same result.

The article appearing on the economic use of static condensers in this issue by Prof. Waldo V. Lyon deals with the annual cost of condensively reactive power as obtained by the installation of static condensers. This annual cost is taken as a certain fixed charge for the first element of condenser, plus a charge proportional to the capacitance of the condenser. Then, so far as concerns economy in line copper versus condensers, there is shown to be a certain relation between the installation costs and the various other factors at which it will pay to install the condenser. Otherwise it will be more economical to increase the size of the copper line wires.

Of course, the best plan is to avoid the development of a lower power factor in the system by encouraging the growth of lighting and discouraging the installation of induction motors, especially when they are selected too large for their duty and run for long periods underloaded. It may be said that customers on the system are unaware of the troubles they may produce for the central station when they install many induction motors with large margins of service capacity. Nevertheless, it is only fair to the power station and to the other customers supplied therefrom that a certain increased rate per kilowatt-hour should be charged when reactive power is absorbed. Contracts for alternating-current service should include a clause for an increase in the power rates, acccording to an equitably established sliding scale, if the average power factor of the customer's load falls below an assigned value. It would then be to the customer's advantage to insist that the motors or other apparatus he may purchase and install shall not involve him to an unwarranted degree in operating expenses.

Incandescent lamps attain almost exactly the ideal 100 per cent power factor. Induction motors, and ironclad apparatus in general, absorb inductively reactive power and lower the power factor. Overexcited synchronous motors and static condensers absorb condensively reactive power and raise the power factor, but they are expensive. Up to the present time no other device has been produced or discovered which, while useful on its own account, also absorbs condensively reactive power. Inventors have sought in vain for a useful electric device which would improve the power factor by acting as a condenser during the time of its operation. Incandescent lamps help the system power factor, but only by diluting the motors already connected. Static condensers certainly help, as Professor Lyon shows, and by direct reactive operation; but they are expensive and they are of no use in themselves. No one at present wants to connect a condenser to the mains on his premises for any purpose except to compensate some of the idle magnetizing current in inductive apparatus and thereby raise the power factor.

Economic Use of Static Condensers—I

Problems of Power-Factor Correction by Static Condensers Are Analyzed for Purposes of Improving Voltage Regulation and Reducing Copper Losses—When and to What Extent It Pays to Install Condensers

BY WALDO V. LYON
Assistant Professor of Electrical Engineering, Massachusetts Institute of Technology

FOR fixed voltage the capacity of generating and transmission equipment is limited by current and not by power. For this reason any energy-absorbing device that operates below unity power factor puts an additional burden on the central station. Since it costs more to generate and to distribute one kilowatt-hour at 0.7 power factor, for example, than at unity power factor, a consumer should pay for the kilowatt-hours he receives, and in addition a charge determined by the power factor of his load. This procedure enhances the virtue of operating at a high power factor, and logically tends to increase the use of power-factor-correcting devices, the simplest of which is the static condenser. The object of this paper, then, is to discuss some of the economic principles involved in the installation of static condensers for power-factor correction. Only a brief outline of the theory is given, but examples are worked out showing the application of formulas.

The fundamental principle is that the entire annual cost that may be charged against the installation of the condenser shall not be greater than the annual saving it accomplishes. The standard net profit that is here adopted is the greatest that can be obtained. That is, the size of condenser will be determined which will make the net profit (the difference between the annual saving the condenser accomplishes and its own annual cost) a maximum. There is one exception to this statement. When a condenser is used to improve the voltage regulation of any circuit the saving may in part be capitalized as the asset "good will." "Good will," being more or less indefinable, is not considered here. Neither is construction or installation of condensers dealt with.

Problems of increasing the capacity of generators already installed and reducing the equipment required in a new plant by the use of condensers will be taken up in the second installment.

FACTORS TO BE CONSIDERED

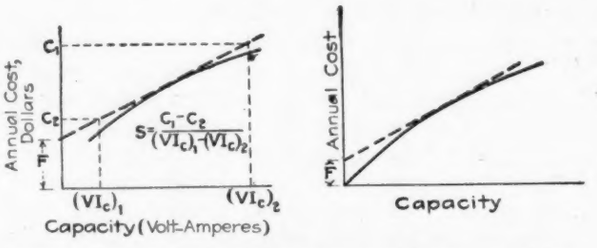
The annual expense of installing and operating the condensers may be divided into the following items: (1) Interest, taxes and insurance on the first cost as installed; (2) depreciation and repair; (3) housing; (4) attendance or control.

(1) The current that a condenser takes varies directly with the frequency, so that the size of a condenser that will take a given leading current varies inversely with the frequency. For this reason condensers would have to be very cheap to warrant their use on a 25-cycle circuit. It might be economical to build condensers to operate at some fixed voltage and to connect them through transformers to any circuit with a higher or lower voltage. The first cost is, of course, somewhat higher when transformers are used. The economic and electrical characteristics of a condenser depend principally upon the dielectric which is employed. A dielectric material which is cheaply produced and has better mechanical and electrical properties, particularly in regard to its specific inductive capacity, than any in common use to-day would stimulate the use of condensers for power-factor correction.

(2) On account of the simplicity of construction and the absence of moving parts, the annual charges for depreciation and repair should be very low.

(3) Condensers may be placed either in the central station or the substation or at other points in the distribution system. In the former case the cost of housing may be balanced by the cost of providing space for generating apparatus which would be necessary if condensers were not used. In the latter case the condensers may be placed upon transmission poles or underground in manholes, reducing the cost of housing to a very small amount, or they may be placed in rented space, the cost of which will vary greatly, depending upon local conditions.

(4) The attendance that condensers require is of the simplest sort—that is, the closing and opening of a switch at stated times of the day. The cost of this, however, may be a large proportion of the total yearly expense, especially with small units. But there are two ways of reducing this cost. The first is a system of remote control by which the opening and closing of the condenser switch may be performed at the power house or substation. The second is an automatic device which would open and close the condenser switch at stated times of the day or when the wattless current in the circuit has a predetermined value, closing the switch when the wattless current rises above a certain value and opening the switch when the current falls below this value.



TOTAL ANNUAL EXPENSE OF CONDENSER INSTALLATIONS
Fig. 1—Including charge for housing. Fig. 2—Where housing cost is zero

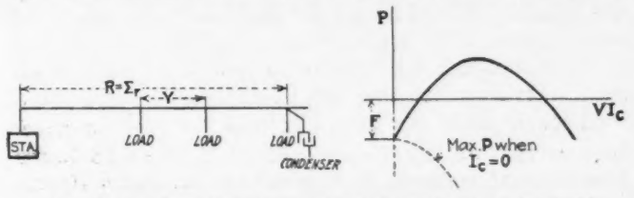
The total annual expense of the condenser is best represented by plotting the annual cost against volt-ampere capacity and then drawing a smooth medial curve such as shown in Fig. 1. The abscissas of this curve are the volt-ampere capacity of the condenser, while the ordinates are its total annual cost in dollars. The simplest method of analysis is, having determined the approximate volt-ampere capacity by preliminary calculation, to draw a tangent to the cost curve at this predetermined point and then assume that this tangent line expresses the true relation between the annual cost

and the volt-ampere capacity. The tangent relationship for the annual cost, C, is

$$C = SVI_c + F \qquad (1)$$

In this expression S is the "slope cost" and F is the "fixed cost." These terms will subsequently be referred to a number of times. (See Fig. 1.)

If the cost-capacity curve is essentially a straight line, it will not be necessary to make any preliminary calculations. Should it be deemed advisable to do this, however, the approximate value of the condenser capacity may be found by inserting in the proper equations—(4), (13) and (21)—an *average* value of the "slope cost" of the condenser. The value of the "slope cost" is determined principally by items (1) and (2), while the value of the "fixed cost" is determined principally



FIGS. 3 AND 4—CONDENSER INSTALLATION FOR REDUCING COPPER, AND ANNUAL PROFIT CURVE

by items (3) and (4). Of course neither S nor F is constant, the former decreasing and the latter increasing with the size of the condenser. If there are no charges for housing and attendance, the fixed cost, F, although it may be quite small, is not zero, as indicated in Fig. 2.

PURPOSES SERVED BY CONDENSERS

Condensers may be added to a new installation for the purpose of reducing the necessary generating and transmission equipment, or they may be added to an existing system to increase its capacity, to reduce the copper loss or to improve the voltage regulation. In any commercial problem a combination of these advantages would probably be sought, but for the purpose of analysis it is much clearer to consider each case separately. This is done in the present analysis.

Commercial condensers operate at so low a power factor that the power they absorb may be disregarded without appreciable error. The entire analysis is further much simplified if it be assumed that the phase of the line voltage is fixed throughout the transmission system. The error that is thus introduced is so small and the complication that is avoided is so great that the assumption is fully justified.

When considering three-phase circuits it is probably least confusing if the calculations are made for one phase only. If the condensers are to be connected in Y, the phase voltage is the line voltage divided by $\sqrt{3}$, the phase current is the line current, and the phase power is the total power divided by 3. If the condensers are to be connected in Δ the phase voltage is the line voltage, the phase current is the line current divided by $\sqrt{3}$ and the phase power is the total power divided by 3. The volt-ampere capacity of the condensers is the same for either connection.

IMPROVING VOLTAGE REGULATION

Except as stated above, the use of condensers for the sole purpose of improving the voltage regulation does not primarily involve economic principles. With a load taking constant power—a motor load for example—an increased load voltage results in a decreased current consumption and a reduced line copper loss. On the other hand, a load of approximately constant resistance—a lamp load, for example—consumes more power and thus entails a greater copper loss if the line voltage is increased. The change in the line loss brought about in this manner would ordinarily be small and of secondary importance. If we disregard the effect that the increased load voltage may have on the line current and power factor, the increase in voltage obtained by the use of condensers is essentially equal to the product of the line reactance and the current taken by the condensers; that is, is nearly proportional to the capacitance of the condensers. The most economical use of a given capacitance is to place it all at the point where the voltage is to be raised. There is no advantage in subdividing the condenser and placing the parts at several points along the line. It is for this use only that there is any advantage in adding condensers until the resulting current is a leading one. When considering line loss or the capacity of generating and transmission equipment, a leading current is essentially just as undesirable as a lagging one. The necessary volt-ampere capacity of the condensers for raising the line voltage k per cent is $kV^2/100X$, where V and X are respectively the line voltage and the line reactance between the generating station and the point at which the condensers are installed. The annual expense of increasing the voltage this amount is then obtained from the cost-capacity curve (Fig. 1).

Example 1.—A three-phase, 60-cycle transmission line 10 miles long with transformers at each end consists of No. 0 conductors in the same plane, with 30 in. (76.2 cm.) between the center and outer conductors. The transformers have a combined resistance and reactance drop of 2 and 10 per cent respectively. The line supplies a load of 2700 kw. at 0.6 power factor and 13,200 volts. Compare the cost of duplicating this line on the same poles with the cost of condensers that will give the same increase in the voltage regulation.

Resistance and reactance of single line $= 5.18 + j6.64$

Resistance and reactance of transformers $= 0.77 + j3.87$

Total resistance and reactance $= 5.95 + j10.51$

Line current referred to line voltage $= 118 - j157.5$

Line drop $= 118 \times 5.95 + 157.5 \times 10.51$ approximately
$= 2357$ volts approximately.

Resistance and reactance of double line and transformers
$= 3.36 + j7.19$

Line drop $= 118 \times 3.36 + 157.5 \times 7.19$ approximately
$= 1529$ volts, approximately.

Reduction in line drop $= 2357 - 1529 = 828$ volts.

Necessary kilovolt-ampere capacity of condenser to accomplish this same reduction
$= 828/10.51 \times 13{,}200/\sqrt{3}$ volt-amp.
$= 601$ kva. per phase

Cost of duplicate line:*		Cost of condensers at $15 per kva.:	
Cross-arms	$310	3×601×$15 =	$27,100
Insulators	576		
Copper, at 17 cents	8,700		
Labor	1,000		
Total	$10,586		

REDUCTION IN COPPER LOSS

The saving in power in any section of a distribution system due to the introduction of condensers at the end of the section is equal to $r(2I_wI_c - I_c^2)$ where r is the

* Data taken from "Overhead Electric Power Transmission," by Alfred Still.

resistance of this section of the system, I_w is the wattless lagging component of the current in the section before the addition of the condensers, and I_c is the leading current which the condensers take. The copper loss is reduced if I_c is not greater than twice I_w. The greatest reduction is obtained when I_c equals I_w; that is, when the power factor of this section of the system is increased to unity. The effect of adding the proper amount of capacitance at any point in a system is to reduce the copper loss in all sections between this point and the central station. In order to effect the greatest saving in line loss, a given capacitance should therefore be removed from the central station until the capacitance current is as nearly equal as possible to, but not greater than, twice the initial lagging wattless current at this point. If it is possible, however, to subdivide this given capacitance into smaller units, the greatest saving in line loss will be obtained when the capacitance is distributed along the line so that the power factor is unity in as many sections as possible. This latter arrangement is, of course, much more expensive in every respect.

Economy of Adding Condensers to Reduce Copper Loss

The general problem of determining whether or not it is economically feasible to add condensers for the sole purpose of reducing the copper loss in the distribution system is too complicated to express in any simple equation. The general method of solution can be indicated clearly enough by considering a single transmission circuit which supplies power to several loads connected to it at irregular intervals. (See Fig. 3) Let p represent the cost in dollars per watt-hour of energy at the switchboard, and H the hours per year that the condensers are in operation. The resistance of any section of the line between adjacent loads is r, and the average wattless current due to the loads in the section while the condenser is in operation is I_w. The annual cost of the condenser is $SVI_c + F$; S and F are determined as shown in Fig. 1. The net annual profit, P_r, in dollars, considering both the reduction in the copper loss and the cost of the condenser, in any section of the line, is

$$P_r = pHr\ (2I_wI_c - I_c^2) - SVI_c - F \qquad (2)$$

This equation for the profit is a parabola, as shown in Fig. 4. The total profit, P, in all of the sections between the point where the condenser is connected and the generating station is thus

$$P = -1000\ pHRI_c^2 + (2pH\Sigma rI_w - SV)\ I_c - F \qquad (3)$$

The condenser, of course, does not affect the line beyond the point at which it is connected. Differentiation of this equation for the net annual profit shows that it has its greatest value when

$$VI_c = (V\Sigma rI_w/R) - (SV^2/2pHR) \qquad (4)$$

If this greatest profit occurs when the condenser current is zero, as shown by a parabola with its vertex on the P axis, it will never pay to add a condenser. This condition determines the greatest value that S can have. That is, if S is greater than $(2pH/V)\Sigma rI_w$, the addition of a condenser will occasion a loss which will increase as the size of the condenser increases. If S is less than this critical value, there will be a net profit or loss depending upon the value of F. The critical value of F is readily found. If the value of I_c which makes the profit a maximum is substituted in the general equation for the net profit, the maximum profit is found to be

$$P_m = pHR\left(\frac{\Sigma rI_w}{R} - \frac{SV}{2pHR}\right)^2 - F \qquad (5)$$

F in this equation must be less than

$$pHR\left(\frac{\Sigma rI_w}{R} - \frac{SV}{2pHR}\right)^2$$

or P_m represents a loss. Thus the general relations which must hold for the annual cost of the condenser if the installation is to produce a profit are

$$S \text{ less than } (2pH/V)\Sigma rI_w \qquad (6)$$

$$\text{and } F \text{ less than } pHR\left(\frac{\Sigma rI_w}{R} - \frac{SV}{2pHR}\right)^2 \qquad (7)$$

Example 2.—A three-phase, 60-cycle, 13,200-volt transmission line of No. 6 conductor is 7 miles long. A single balanced load at the far end takes 600 kw. at 0.4 power factor, 2000 hours per year. The resistance drop in the generator and transformers at this load is 4 per cent. Assume that the cost of energy at the station with coal at $5.50 per ton, is $0.0053 per kw.hr.

Line current $= 600/(0.4 \times \sqrt{3} \times 13.2) = 65.6$ amp

Line current referred to line voltage $= 26.2 - j60.1$

Total resistance per phase $=$

$7 \times 2.12 + (0.04 \times 7620)/65.6 = 19.5$ ohms.

By (6) the critical value of S is

$(2 \times 0.0106)\ (19.5 \times 60.1/7620)$

or $3.26 per kva.

Assume cost of condenser as installed to be $18 per kva., and annual charges—items (1) and (2)—to be 12 per cent, then

$S = 0.12 \times \$18.00 = \$2.16$ per kva.

The proper capacity of condenser is by (4)

$$VI_c = 7620 \times \frac{19.5 \times 60.1}{19.5} - \frac{0.00216 \times 7620^2}{2 \times 0.0106 \times 19.5} \text{ volt-amp.}$$

$= 155$ kva. per phase.

By (7) the fixed charge—items (3) and (4)—must be less than $3 \times 0.0106 \times 19.5 \times (20.3_2)^2$, or $240.

The power factor is increased so that

$$\tan\theta = (60.1 - 20.3)/26.2.$$

The resulting power factor is 0.55.

If the actual cost of generating energy at the station is twice as much—*i.e.*, $21.2 per kilowatt-year—the critical value of S is also twice as great, *i.e.*, $6.52 per kilovolt-ampere.

The proper capacity of condenser is then:

$$VI_c = 7620\left(60.1 - \frac{2.16 \times 7620}{2 \times 21.2 \times 19.5}\right) \text{ volt-amp.}$$

$= 306$ kva. per phase.

The critical value of F is now $3 \times \$0.0212 \times 19.5 \times (40.2)^2$, or $2,000. If the housing and attendance charge is $500 per year, the annual profit is $2,000 — $500 = $1,500.

The new power factor is now 0.80.

In order that condensers may show a profit when they are installed to reduce copper losses, the cost of generating energy per kilowatt-year must be high, the line loss must be high, the power factor must be low, considerable power must be transmitted, and the fixed charges on the condenser must not be excessive.

According to Kelvin's law, the best size of conducto for this transmission is No. 0, assuming cost of generating energy at $21.20 per kilowatt-year, copper at 22 cents a pound and interest and depreciation, etc., at 12 per cent. With this size of conductor the critical value of S is $0.00277 per volt-ampere and the critical value of F is but $93. In such a case the installation is hardly advisable.

Water Economy in Hydroelectric Plants

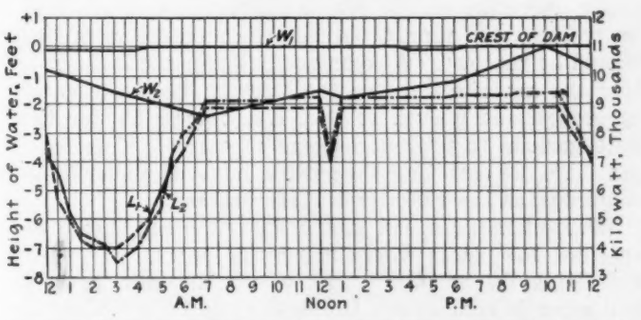
Intelligent Conservation of Excess Water May Save Coal in the Operation of Combined Hydroelectric and Steam Plants—In Some Cases the Power Factor of the Hydro-Generator May Be Raised in Order to Utilize Available Water

BY L. W. WYSS
Peninsular Power Company, Iron Mountain, Mich.

WHERE hydroelectric plants are synchronized with steam generating plants it is of the utmost importance that the efficiency of the hydroelectric plants be watched as closely as that of the steam plants, because a loss at the hydroelectric plants results in more coal being used at the steam stations. There are so many local conditions which govern the operation of any hydroelectric plant that the writer will not attempt to generalize on the subject; it is his intention rather to explain some ideas which have been worked out in the actual operation of plants in the belief that these may be applied where local conditions permit.

One of the most important considerations in connection with the operation of a hydroelectric plant is the proper conservation of excess water. During high-water periods when the waste gates are opened high tailwater may decrease the effective head at the dam unless the water has a good chance to run off. The loss of effective head due to high tailwater sometimes decreases the output of a plant more than the loss of head due to low headwater. A considerable increase in the daily load can be obtained by wasting the bulk of the flood water during the hours when the total output of the plant cannot be used, as at night and early morning.

In the accompanying diagram the load and water elevation curves furnish an example of the bad effects of high tailwater, and it is shown how these effects may be overcome. The load curve and water elevation for



OUTPUT OF PLANT INCREASED BY ALLOWING EXCESS WATER TO RUN OFF AT NIGHT

one day are found by referring to curves L_1 and W_1. In this case the flood water is regulated through the waste gates to keep the headwater at the crest of the dam. It is noticed that the maximum load of the plant is 8900 kw. From 7 a.m. to 12 noon and from 1 p.m. until about 10:30 p.m. the waterwheel gates are wide open and the steam plants are doing the regulating. On the same diagram another day's load and water elevation curve are shown, curves L_2 and W_2. In this case the flood water is wasted through the gates during the night when the full capacity of the plant cannot be used. In doing this the headwater is lowered 2.4 ft. (73 cm.) before morning. At 7 a.m., then, when the full capacity of the plant can be used the waste gates are closed and the tailwater drops to normal. It is seen that the plant can handle from 200 kw. to 450 kw. more in case of low tailwater than on the day the headwater was kept at the crest of the dam, even though the headwater did not reach the crest of the dam until 10 p.m. In this case the noon hour also was used to discharge the excess water. The argument applies particularly to the case of a hydroelectric plant in which the tailwater cannot be discharged freely.

On the other hand, in case the channel of the river permits a ready discharge of tailwater the excess water of the system should be handled differently. In this case the water may be raised to a point above the crest of the dam on Sundays and holidays, thus making use of the volume of water represented by the area of pondage times the height of the water surface above the crest of the dam. It is assumed, of course, that the factor of safety of the dam design and construction is sufficient to permit the additional pressure caused by the higher water elevation. For a specific example may be taken the case of a 44-ft. (13.4-m.) dam with a pondage of 1020 acres (410 hectares). In August the river flow was seen to decrease, and the indications were that a drought was in prospect. During the previous week the headwater had been pulled down 0.8 ft. (24 cm.) below the crest of the dam, but it had again reached the crest at 7 p.m. Sunday on account of the light Sunday load. Instead of opening the waste gates at 7 p.m. Sunday, the water was allowed to rise above the dam, and at 7:30 Monday morning it was 0.45 ft. (14 cm.) above the crest. Eleven days later the water had fallen 3.5 ft. (1.07 m.) below the dam crest and the auxiliary steam plant was started to help supply the load since there had not been sufficient rainfall to promise relief from the drought. It was not deemed advisable to pull down the head any more at this time because of the decreased efficiency of the plant under low head.

It may now be understood that under these conditions the water saved from 7 p.m. Sunday until 7:30 Monday morning made possible a large saving in coal. The water which flowed over the crest of the dam and gates was negligible in this case since this cross-section is small compared with the saving effected in the stream reservoir.

Now to determine how much coal was saved:

$$1020 \text{ acres} = 44{,}431{,}200 \text{ sq.ft.}$$

$$44{,}431{,}200 \times 0.45 = 19{,}994{,}040 \text{ cu.ft.}$$

The hydroelectric units deliver 1200 kw. when water is flowing through them at the rate of 400 cu.ft. per second.

$$400 \times 3600 = 1{,}440{,}000 \text{ cu.ft. per hour.}$$

$$19{,}994{,}040 \div 1{,}440{,}000 = 13.9$$

This extra stored water, therefore, would deliver 1200 kw. to the line for 13.9 hours or about 16,680 kw.-hr.

To find the coal saved with the steam plant burning 4 lb. per kilowatt-hour:

$$16{,}680 \times (4/2000) = 33 \text{ tons (approximately)}$$

of coal saved.

HYDRO-GENERATOR POWER FACTOR IS RAISED

Another idea which might not occur to the operator of a combined hydroelectric and steam generating system is to raise the power factor of the hydroelectric generator, in order to use water corresponding to the full kilowatt capacity of this generator. At first thought it might be suggested that a synchronous condenser be used for power-factor correction, but there are sometimes other machines on the line which are not fully loaded and which may be used to raise the power factor on the hydro-generators.

Take, for example, a system composed of hydroelectric and auxiliary steam plants in which the load increased so that the hydroelectric plant could not handle it alone during the heavy-load periods. A 2800-kva. steam turbine was operating on the system, delivering from 200 kw. to 1500 kw., or more when the water supply is full. Two generators at the hydroelectric plant rated at 1820 kva. were unable to generate over 1400 kw. without dangerous heating because the power factor of the system was between 0.7 and 0.75. The turbines, however, were rated at 2400 hp., or 1790 kw., and by increasing the field excitation of the steam turbine generator so that the hydro-generators could deliver power at 0.9 to unity power factor, the hydroelectric plant was able to run with turbine gates wide open, delivering approximately 1800 kw. instead of 1400 kw. The increased field excitation of the steam-driven generator caused a considerable wattless current to flow in this machine. But since the steam-driven generators were not loaded the increased heating was not serious, and a very substantial saving in coal was effected by running the hydroelectric units at full rated capacity.

COAL SAVED BY CLEARING TRASH RACKS

As pointed out in an article by E. A. Gibbs in the ELECTRICAL WORLD for Jan. 4, 1919, the trash racks should be kept clean in order to avoid a loss of head in the racks. The writer once observed an instance of failure to clean the racks in the case of a 5700-hp. plant. The water level averaged about 6 in. (15 cm.) lower inside the racks than outside, the effective head being 32 ft. (9.75 m.). The loss of 6 in. (15 cm.) of head represents 1.5 per cent of the capacity of the plant. In the case of the plant in question the full capacity of the plant could be used about 400 hours during each month. The horsepower capacity thus rendered useless at the hydroelectric plant and the consequent burning of ocal at the steam plant is estimated as follows:

$$1.5 \text{ per cent of } 5700 = 85.5 \text{ hp., or } 63.8 \text{ kw.}$$

$$63.8 \times 400 = 25{,}540 \text{ kw.-hr.}$$

This the steam plants had to generate using 4 lb. of coal per kilowatt-hour. Consequently some 50 tons of coal were wasted each month, whereas fifteen hours of labor would have kept the racks clean. The fact that hydroelectric units operate efficiently at certain loads near full capacity, moreover, must not be lost sight of.

It is good operating practice when water is abundant to have plenty of machines in service, so that an unexpected failure of one of them will not disturb the service. When water is scarce, just enough machines should be kept running to handle the peak loads. Each unit then operates at maximum efficiency. Without proper supervision the operating force may fail to take advantage of this possible saving. The reason is that the operators realize the difficulty of synchronizing another machine when the generators on the system are so overloaded that it becomes difficult to keep the frequency steady. Modern hydroelectric units and their governors are reliable enough to permit full confidence to be placed in them if they are attended to properly. Some preventable governor failures are now mentioned, caused by (1) worn parts which should have been replaced, (2) loss of oil pressure due to pump failure or operator's mistake in handling valves, (3) delicate moving parts obstructed by friction due to dirt or lack of oil, (4) dash pot, relay valve or regulating-valve packing glands drawn up too tight. (5) important adjusting levers, etc., being moved unintentionally by attendants while wiping, (6) breakage of governor belt.

Leakage of water through the dam should be prevented, as this often amounts to considerably more power than would at first thought be expected. The water flowing from small leaks spread along a dam a quarter of a mile long would make a good-sized stream if combined.

STOPPING LEAKS AT WASTE GATES

Most of these leaks can be prevented in some way. Common places to find them are at the sides and bottom of waste gates. Ordinary cinders are adapted to stop these leaks as their specific gravity is such that they sink very slowly, allowing the current due to the leaking water to lodge them in the right places to stop the leaks. Front-end cinders from locomotives are recommended where the leaks are small as their specific gravity is more uniform, but they are too fine for most purposes.

Another method which has been tried with good results is to drag water-logged wood from the river and cut it into chips and then use these in place of cinders.

Cinder spouts can be made to guide cinders to the leaks where obstructions prevent dropping them directly above the leaks. Where rubber gaskets are used on waste gates they often get worn out or torn and should be replaced. A common fault causing leakage is that the concrete walls on the sides of the waste gates are rough and uneven so that it is impossible for the gate gaskets to prevent leakage of water. This leakage increases each time the gates are moved, under these conditons, as the gasket will soon wear out.

When planning a new dam a smooth finish should be specified for places where leaks may occur. Strips of tin inside the wooden forms where the gate gaskets will come in contact are advisable.

THE most vicious wrong in democracy is the abuse of power—the betrayal of the people by their own agents—and the only protection from this evil, when the rights of persons and property are concerned, is to be found in courts of justice. We have, of course, a government of men—there is no other government—but we have a government of men whose duties are defined by law, and hence a government of law, and there never should be hesitancy to unmask the officer who usurps power.—*Charles E. Hughes.*

Features of Muscle Shoals Station

Factors Considered in Building Steam-Power Plant Which Serves Largest Single Industrial Load in World, with Load Factor of 90 per Cent—Rapid Construction, Continuous Service and High Economy Were the Main Desiderata

BY EDWARD R. WELLES AND W. A. SHOUDY
Mechanical Division the J. G. White Engineering Corporation

WHEN the United States government decided to build its second nitrate plant* at Muscle Shoals (near Sheffield, Ala.) the demands for nitrates had so greatly increased that its rated output was set at about four times that of Plant No. 1. The total power requirements were estimated at 70,000 kw. to 90,000 kw., the average expected load being about 75,000 kw. This is probably the largest load required by a single industrial plant in the country, if not in the world. Some idea of the magnitude is obtained when it is remembered that the *average* power requirement of this plant nearly equals the winter peak of the Brooklyn Edison Company system for 1917.

No designs for this station existed when the contract was assigned to the engineers, nor had any apparatus been purchased or the station load determined, yet only one year was allowed for its erection. In spite of the serious delays in the delivery of material the work was apparently up to schedule when the armistice was signed and rush work stopped.

A year was too long to wait for the delivery of nitrates, and since it was found that a portion of the process buildings could be erected in quicker time than that required for the complete power station, it was decided to obtain a part of the necessary electric power from the Alabama Power Company, transmitting the energy over a high-tension line approximately 85 miles (135 km.) long. Somewhere between 20,000 kw. and 30,000 kw. will be taken over this line; the average load carried by the station will therefore be in the neighborhood of 50,000 kw. to 55,000 kw.

The desire eventually to manufacture nitrates commercially, instead of for war purposes, made it desirable to adopt a design which would assure high operating economy if this would not delay the erection program. The great importance of nitrates to the carrying on the war also required that after once starting this plant there should be no voluntary shut-down until peace was declared. Such conditions required a design of buildings and a selection of apparatus which would insure the following results: (1) Rapid construction; (2) continuous service; (3) high economy.

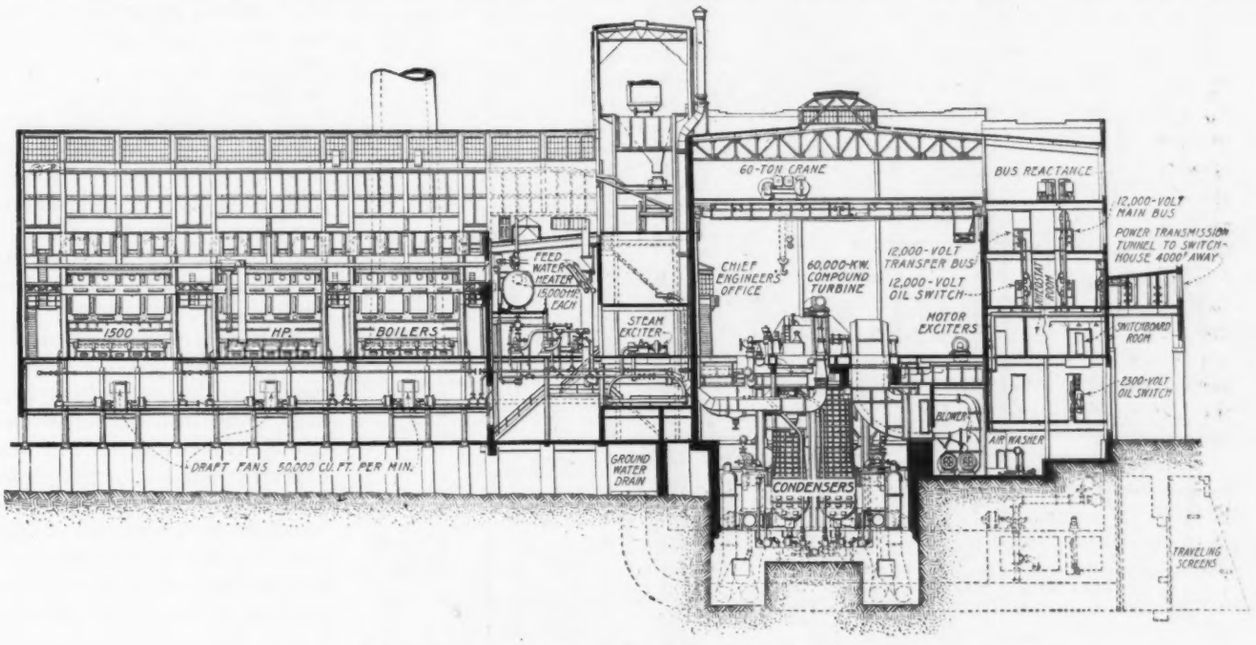


FIG. 1—CROSS-SECTIONAL VIEW OF THE POWER PLANT

EFFECT OF LOCATION ON DESIGN

The process buildings of nitrate plant No. 2 are located on a tableland about 125 feet (35 m.) above the Tennessee River, this tableland extending to the edge of the river, where it drops very abruptly. Owing to the large quantity of cooling water required by the generating station, it had to be placed as near the river level as practicable, so it was erected in one of the narrow ravines near the site of the process buildings. The area available for the station was so limited that at the elevation of the turbine-room and boiler-room floors the station completely fills the ravine. Because of this condition it was possible to make the substructure serve as a sort of dam that would protect the station against

*See the issue of the ELECTRICAL WORLD for April 5, 1919, regarding conditions that led up to building of Muscle Shoals plants.

a total river rise of about 37 ft. (11 m.), or the maximum head that would likely arise more than once in fifty years.

The cost of constructing a discharge tunnel at low-water elevation was found to be so expensive that it was decided to place this tunnel about 4 ft. (1.2 m.) above this level. This elevation was selected because the extreme low-water conditions would prevail for only a few months each year and the additional cost of pumping these few feet would not warrant the expenditure for a discharge tunnel at a lower elevation. To provide for a full siphon effect for the circulating-water system, the condensers were so set that the highest point in the system would not exceed 25 ft. (8 m.) above the level of the water in the discharge tunnel, thus necessitating the excavation of a condenser pit 50½ ft. (15.4 m.) below the turbine floor. It was necessary to excavate still further to provide for the condensate pumps.

Between 30,000,000 gal. and 40,000,000 gal. (115,000,000 l. to 150,000,000 l.) of water per day must be taken from the Tennessee River for the process work, so it was decided to combine the intake for the power house and that for the process buildings into one unit and place the pumps for the process building in the power house. The intake and discharge tunnels were constructed in the bed of the ravine, the intake tunnel being carried out into the river and a six-section revolving screen being installed at the power house. Inside of the screen the intake tunnel is in two sections and so designed that one-half may be closed for repairs and still permit operation. To minimize excavation the pumping equipment was placed as shown in Figs. 1 and 3.

All of the coal supplied this plant will be delivered over a railway trestle about 65 ft. (20 m.) above the boiler-room floor, this elevation corresponding to that of the ground on each side of the power house. From the coal hopper, which is situated between the turbine and boiler rooms, the coal is emptied into a crusher discharging onto a belt conveyor, which in turn delivers the coal to the bunkers. It was expected that the ash would be used for some years for filling in the ravine or around the process buildings, so arrangements have been made for cars to be run directly under the ash hoppers and taken to either place by electric locomotives. The coal and ash handling system is probably the simplest that can be found in any station.

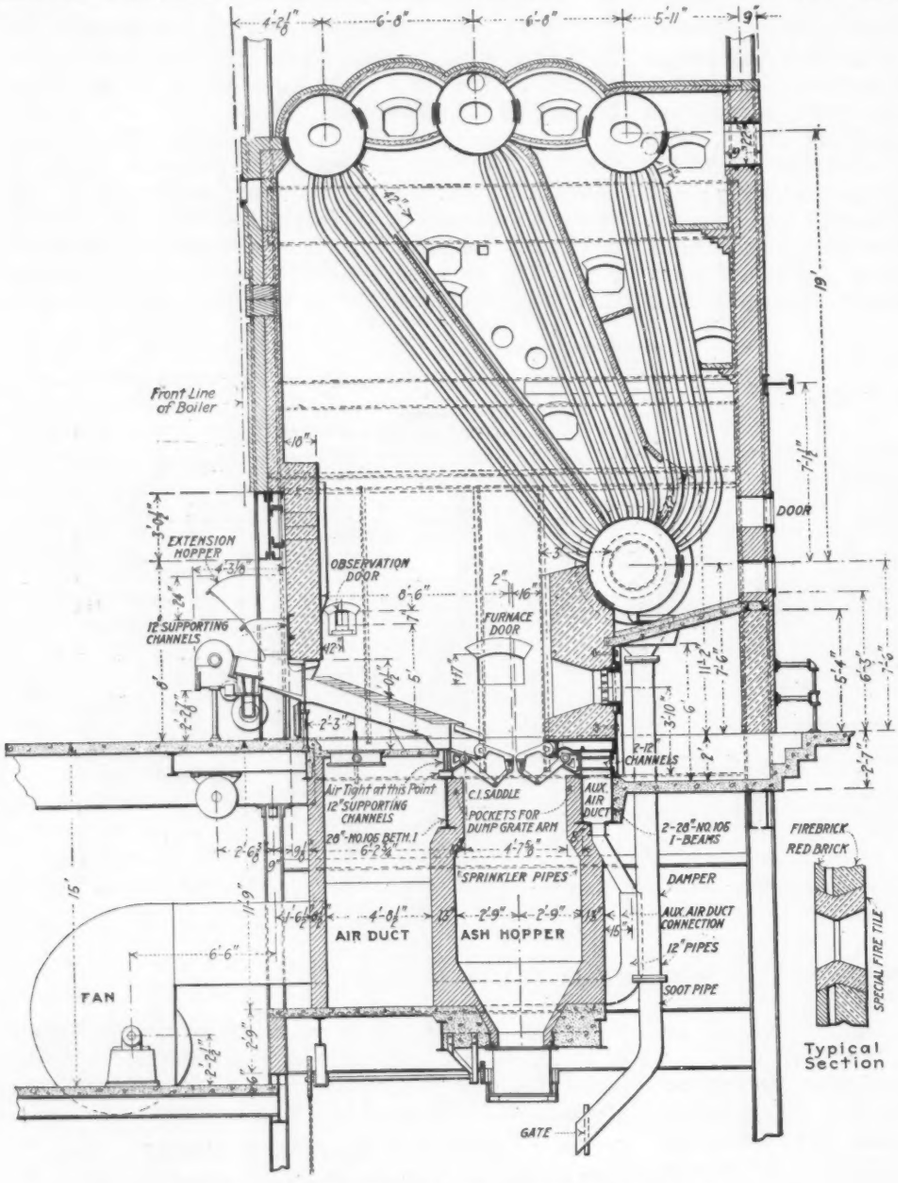


FIG. 2—BOILER, FURNACE AND STOKER CROSS-SECTION

It was impossible to learn definitely the type of coal that would be available for this station because of the existing shortage, although it was expected that coal would probably come from the Alabama or Tennessee district. Because of this uncertainty and the absolute necessity of maintaining continuity of service, it was decided to install 18,000 hp. in boilers. These should provide sufficient reserve in case the transmission line fails at a time when the coal is of bad quality.

The great demand for steel plate, due to the large shipbuilding program under way, made it doubtful whether steel chimneys which could be erected upon the building could be obtained promptly, whereas erecting brick stacks upon the building would have required heavier structural work. However, brick stacks built from the ground up could be erected with a minimum interference with other building construction. They were therefore chosen and erected outside the building.

The question of induced draft and economizers was very carefully studied, but because of the high feedwater temperature, which will be explained later in this article, and the fact that the life of the station

was problematical, it was eventually determined to depend upon brick chimneys for the necessary draft.

The problem of providing for large boilers and still affording ample light and ventilation and minimum steam piping was solved by dividing the boilers into two rooms and placing one chimney between these rooms and one at each of the other sides. This also permitted completing one room and operating half the boilers without interfering with the construction of the other room.

FACTORS THAT AFFECTED BOILER INSTALLATION

At the time the boilers were purchased all manufacturers making the straight-tube type were crowded with orders for the Emergency Fleet Corporation, so a limitation was placed on the kind of boiler that could be secured. Besides, the high steam pressure required limited the size of boiler units obtainable. With a reasonable promise of delivery the maximum size of unit which could be purchased was 1500 hp. The boiler eventually decided upon was the Stirling type. By using standard-size superheaters, superheat temperatures of about 175 deg. Fahr. (97 deg. C.) at 150 per cent rating and 193 deg. Fahr (107 deg. C.) at 200 per cent rating could be expected. This being so, the steam characteristics of the station were set at 275 lb. (19 kg.) gage at the turbine throttle and approximately 175 deg. Fahr., although all apparatus was purchased for a minimum of 200 deg. Fahr. (112 deg. C.) superheat. Because of the extremely uniform nature of the load in this station it was expected that the boilers would be operated at nearly constant rating continuously. However, because of the extreme importance of maintaining uninterrupted service, no chances could be taken in operating these boilers at high ratings, with the concomitant rapid deterioration of boiler furnaces and other troubles experienced with high ratings. It was, therefore, determined to operate these boilers at about 175 per cent rating continuously. Because of the possibility of trouble in the transmission line it was necessary to provide for occasional additional demands of about 20,000 kw. At such times the boilers can be forced to higher ratings to take care of this overload.

For the foregoing reasons it was decided to install Westinghouse underfeed stokers (because of the flexibility of this type) with sufficient retorts so that the boilers might be forced to 250 or 300 per cent rating. The stacks were designed to provide sufficient draft to carry 250 per cent of rating with vacuum in the furnace. The large size of the boiler units offered an excellent opportunity for using individual blowers at each boiler and individual motors for each stoker. The logical place for the blowers, which are Green units, was in a gallery directly below the firing aisle. By joining these two galleries with one below the coal viaduct a U-shaped passage was formed which made an ideal pipe gallery, thus placing all principal piping out of the way, yet making it easily accessible.

Since the time required for completion of this station necessarily rested upon the rapidity with which the generating unit could be obtained, an effort was made to obtain a generating unit or units which had already been ordered for work that could be postponed without great inconvenience to the other parties. In this the engineers were successful, a three-phase, 60-cycle, 12,000-volt turbo-generator and condensers, which had been ordered by the Duquesne Light Company, being secured and used without modifications except for minor details.

This turbine is a three-element cross-compound machine rated at 60,000 kw. at 85 per cent power factor and 70,000 kw. at 90 per cent power factor. The three generators employed are tied together electrically. Steam is supplied to this unit through two 18-in. (46-m.) leads. In case of emergency one of these lines may be cut out of service and the entire steam supplied through the other at the expense of a slight pressure drop. The steam leaving the high-pressure element divides and passes to the two low-pressure turbines placed on each side of the first element. Each of the low-pressure elements exhausts into two condensers, having 25,000 sq.ft. (2335 sq.m.) surface apiece, making a total of 100,000 sq.ft. (9300 sq.m.) for the entire unit.

The turbine is so designed that any of the three elements may be operated separately or in combination; *i. e.*, the high-pressure element may be operated with the two low-pressure elements out of service; the high-pressure element may operate in conjunction with either of the two low-pressure elements, one being out of service; the two low-pressure elements may operate

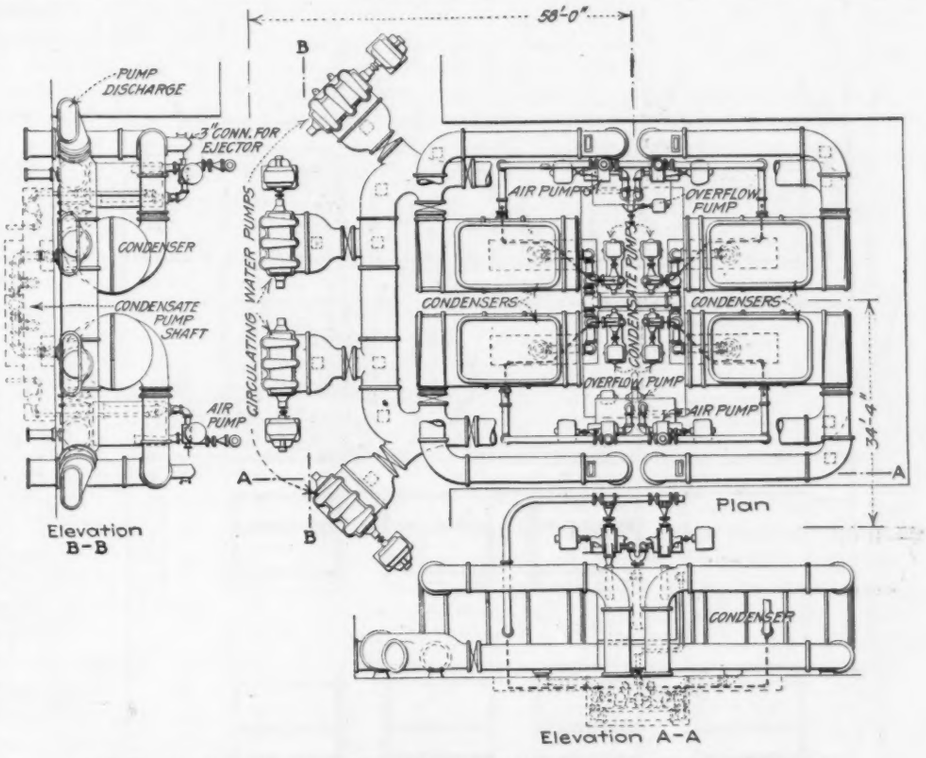


FIG. 3—LAYOUT OF CONDENSERS AND AUXILIARIES AT BOTTOM OF 50-FT. PIT

with the high-pressure element out of service, or either of the low-pressure elements may be operated separately. The governing mechanism is so designed that in case of trouble, electrical or mechanical, in any one of three elements, that element will be cut out of service automatically and the load distributed between the remaining two elements. It is also possible to erect each of these elements separately and put each into service before the entire unit is installed.

Thus the 60,000-kw. turbine will give the same degree of insurance against interruption as three independent 20,000-kw. units, with the additional advantage that, because of its large size, very much lower steam consumption can be obtained. Room is provided for a 30,000-kw. unit, and a third may be installed by extending the turbine room. The turbo-generators, condensers and auxiliaries are Westinghouse units.

Since it was necessary to construct a standard-gage track down the ravine for the delivery of heavy freight, the track was made a permanent one and extended into the turbine room. Heavy machinery may, therefore, be unloaded by the crane from the original cars and deposited at any point in the room. Hatches in the main floor permit the removal of apparatus in the basement and the delivery of them by crane direct to the railroad car. Material for the boiler house will be delivered on the same siding and unloaded at the boiler-room floor wall.

Because of the deep condenser pit employed it was necessary to install immense connecting pieces between each turbine and the condenser shells measuring over 30 ft. (9 m.) long and 15 ft. (4.6 m.) by 10 ft. (3 m.) in cross-section. To make it possible to ship these connecting pieces each was divided into four sections slightly under 8 ft. (2.4 m.) in length. The great length of the exhaust connection between turbine and condenser necessitated taking care of considerable expansion. Because of certain conditions that prevented building the connections with a circular cross-section it was deemed inadvisable to consider the mercury type of expansion joint. Therefore it was decided to suspend the condenser and exhaust connecting piece from the turbine foundation. This construction also eliminated to a large extent the unequal foundation loading which would otherwise be caused by variations of vacuum.

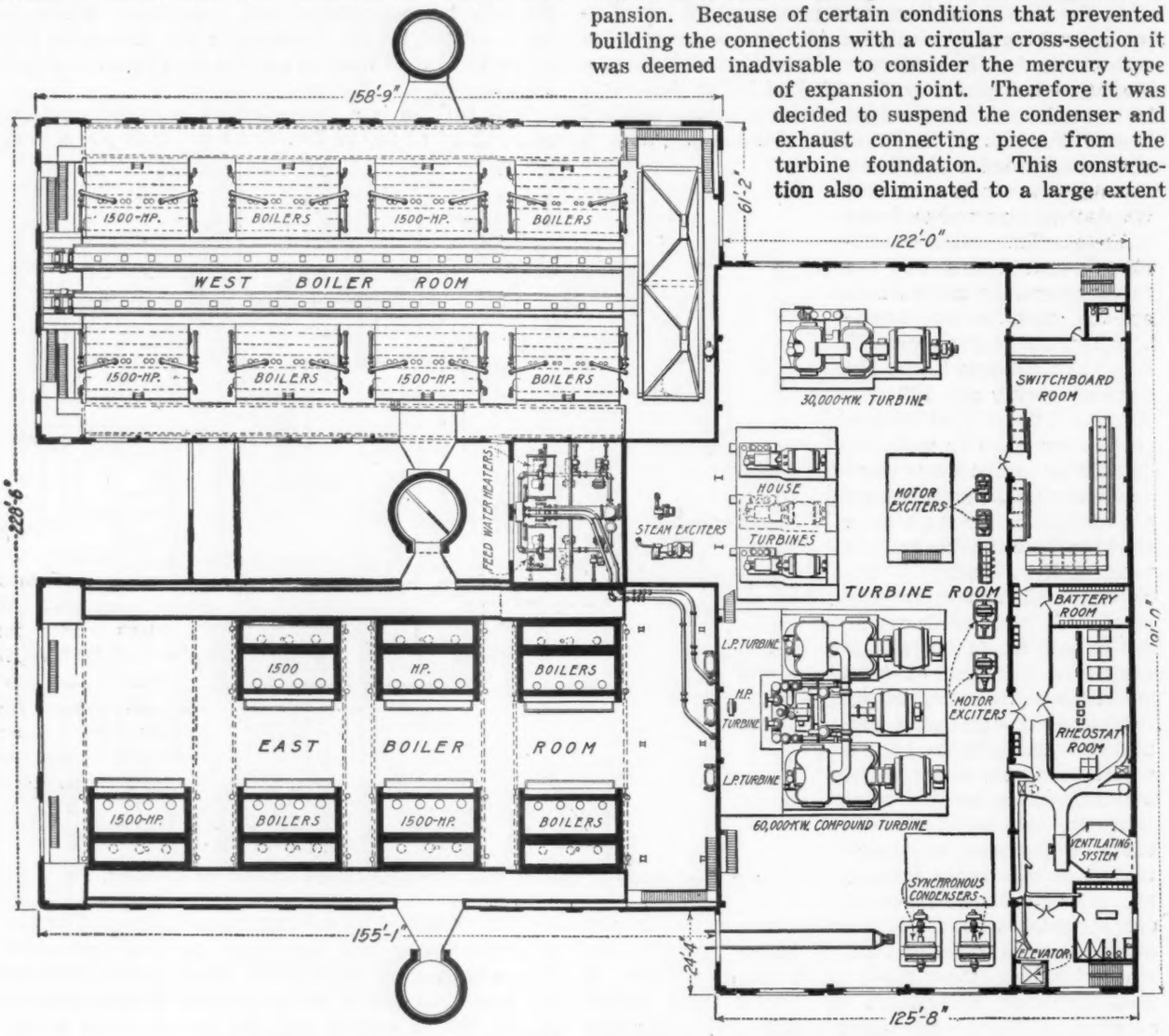


FIG. 4—PLAN OF THE STATION, SHOWING THE COMPLETE LAYOUT AS DESIGNED

Since 132,000 gal. (500,000 l.) per minute of water will be required for circulating purposes under normal operating conditions, four 44,000-gal. (167,000-l.) circulating pumps were connected with a header serving all condensers. With two pumps in service the circulating water will be reduced only about 25 per cent. Four centrifugal-type air pumps are provided, any two of which may be used in the ordinary operation, the other two serving as spares.

Condensate is delivered to two Cochrane feed-water heaters through a dividing box, while make-up water is

supplied through either a 3-in. (7.6-cm.) or 10-in. (2.5-cm.) float-operated valve, depending on how low the water level drops. Water tapped from the condensate lines is also used to cool the turbine-bearing oil and to seal the glands. About one-half of the condensate will be required for the first purpose, in which service it will be heated from 80 deg. to 130 deg. Fahr. (27 deg. to 54 deg. C.). Oil for the main turbine will be filtered by the continuous system, whereas that for the auxiliary turbine will be treated by the batch system, Richardson-Phenix equipment being used.

Electric Drive of Auxiliaries

With the exception of the boiler-feed pumps, which are Worthington units, all auxiliaries are motor-driven. The power is generated by two non-condensing turbines, the exhaust from which is used for heating the boiler-feed water. One factor in this selection was the desire to reduce piping to a minimum because of the high steam temperature and the possibility of delay in obtaining steel valves. Furthermore, the heat balance of the station gave higher economy with electric drive.

The auxiliary turbo-generators are connected with a 440-volt auxiliary bus, which in turn is tied to the main bus through a transformer. In case of failure of the auxiliary turbines the auxiliary load will be carried by the main unit. At the normal station load, which will be about 55,000 kw., approximately 2000 kw. will be required to supply the auxiliaries. However, to maintain the feed-water temperature at about 210 deg. to 215 deg. Fahr. (99 deg. to 102 deg. C.) it will be necessary for the auxiliary turbine to exhaust steam equivalent to a 2400-kw. load. This excess 400 kw. may therefore be used for operating the process pumps, which require a total of about 700 kw. under normal conditions. Four-sevenths of this load will therefore be carried at an energy expenditure equal to the difference between the total heat of the steam at boiler pressure and that at atmospheric pressure. The remaining three-sevenths will be carried by the main turbine through the auxiliary bus. One of these turbines will be operated at a uniform loading near its point of best economy. The second unit will carry any additional load, the exact amount being determined by the back pressure in the exhaust, this being controlled by an automatic valve. It will therefore be possible to operate this station with a feed-water temperature which will not vary more than a few per cent throughout the entire day, and at no time will there be a waste of exhaust steam to the atmosphere.

Since all of the condenser auxiliaries may be operated at practically constant speed, alternating-current motors were selected for this service. In the case of the stoker, however, it was necessary to operate them by direct-current motors because of the wide adjustments necessary in stoker speeds. The motors selected for operating the stoker blowers were alternating-current.

As has been said before, it was decided to operate the boilers at an average rating of about 175 per cent, but there will be times when higher ratings will be required. At such times it will be necessary to operate the fans at a speed higher than normal. Two sets of motors are, therefore, installed, one to operate the fans at their normal speed and the other to drive them at the higher speed, thus securing the best efficiency in each case. In case of failure of one fan two stokers can be operated from one fan through an auxiliary duct, the fan being operated at the higher speed. In case higher ratings are demanded only temporarily, the fan's speed may be changed by using the larger motor.

The electric furnace load which is carried by this central station is an ideal one, and because of its great uniformity it is expected that the load factor will be about 90 per cent. The turbine is one of the most economical yet installed, and so long as the apparatus is maintained in good condition there is little that the operating force can do toward improving the economy of the turbine if the operators must take the load as given to them. It is in the boiler room that the economy may be made or lost. Great attention has been given to this fact. The steam generated is measured by Bailey flow meters and draft conditions are shown by "Three-in-One" draft gages. The speed of the stoker shaft is shown by indicating and recording tachometers. Each boiler is set at sufficient height to provide a combustion space of 17.4 cu.ft. per square foot of projected grate area. Openings are cut into the rear wall so that the firemen may inspect the condition of the fire from the rear as well as from the side. Although each boiler should be operated as an individual unit, it was of the utmost importance that the boiler room be designed so that the room itself could be operated as a unit. Therefore recording instruments and motor controls were installed at one point in the boiler room, where they are under the control of one man. It is expected that the combustion engineer will instruct the gage-board operator regarding the control of each fire.

The space directly over the feed pumps and between the boiler and turbine rooms was set aside for the chief engineer's office. A slightly bayed window in this room makes it possible to view the entire turbine room without leaving this office. This location places the chief's office in the geographical center of the station at a minimum distance from each department. It also made possible the placing of the recording mechanism of both feed-water meters and condensate meters within this office, together with such other instruments as will permit keeping a constant watch over the station operation. These daily records, together with the usual pressure, temperature and vacuum readings, will permit a daily check on the station economy and will amount almost to running the station under test conditions constantly. In fact, an effort was made throughout so to install apparatus that test conditions would be maintained practically at all times.

WHILE the public has the right to exercise intelligent control over corporations which serve it with public necessities, government ownership and management of these utilities would be unwise from every standpoint. It must be remembered by those who so foolishly demand public ownership that year by year the great public utility corporations are becoming more and more the property of the public. Millions of our people have a direct and personal interest in the public serving business, and they are not going to be misled by any of the unsound and theoretical beliefs of the socialists on government ownership. It is but necessary to learn of the numerous disastrous failures of government operations in European countries to indicate what might happen here.—*Cardinal Gibbons.*

Advantages of Spot Welding

The Effectiveness of Spot Welding as Compared with Riveting Is Shown, and It Is Pointed Out that Rivets May Be Driven Noiselessly with Welding Devices—Contact Electrode Shapes Are Also Discussed

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THE substitution of spot welding for riveting of steel plates, as originally proposed for shipbuilding, has received considerable attention of late, and many interesting applications of welding processes have been developed. It is the present purpose of the authors to point out the use of welding apparatus as a noiseless and effective method of driving rivets and to show how the work may be speeded up by dispensing with rivets. A general outline of spot-welding methods is given, with illustrations to show the effectiveness of electrical welds.

Electric welding processes may be grouped under three heads, arc welding, spot welding and butt welding, and combinations of these methods are in use. In arc welding the work is brought to a welding heat by means of an electric arc, either alternating current or direct current, drawn, (a) between the work itself and a carbon electrode; (b) between two carbon electrodes and the arc thus formed between the carbons, which is held in the form of a V used to heat the work; (c) between the work itself and a metal electrode. In the first and second cases a metal rod is used to fill in the weld, while in the third case the metal electrode itself serves as the fill-in metal. By using the proper size of elec-

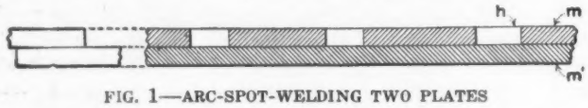


FIG. 1—ARC-SPOT-WELDING TWO PLATES

trode and the proper current both the work and the metal electrode are brought to the fusing point and the electrode is deposited in the weld. It is evident that the metal so deposited is cast steel and that it has the properties of cast steel. The weld may be porous, depending upon the chemical properties of the fill-in rod, the amount of current and voltage used, the length of the arcs and the number of interruptions while making the weld. Hence in the welding of sheet steel, plates, shafting, etc., a given cross-section of the weld cannot be so strong as a similar cross-section of the material welded.

A SUBSTITUTE FOR RIVETING

In arc spot welding (Fig. 1) the upper plate *m* is punched and is laid on lower plate *m*,' which is not punched. The holes *h* are then filled with an arc welder by one of the methods described above, the spots acting as rivets. It has some advantages over the usual spot welding since the machines are cheaper and more easily handled. The advantage over riveting is that only one plate need be prepared, skilled labor is not required to lay out the holes, and the equipment to weld the plates is far cheaper than air equipment to drive rivets. This method is still in the experimental stage and the data are limited as to the strength of the welds and the cost for the different-size plates.

The principle of spot welding by the resistance method (and likewise in butt welding) consists in passing an alternating current of high amperage and low voltage through metals at the point of contact, and when the metal is in a molten state pressure is applied

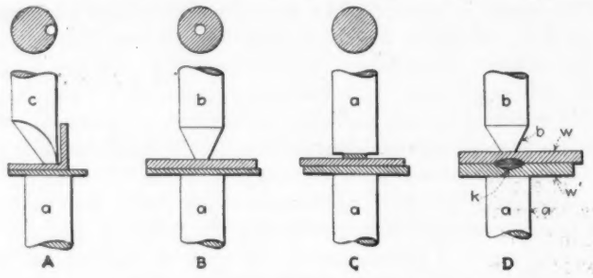


FIG. 2—CONTACT ELECTRODE SHAPES

to force the metals together. The principle is that in a series circuit heat is produced in proportion to the resistance of any particular portion of the circuit. Now, if the conductors leading from the source of supply of current be of low resistance and a piece of metal be inserted, the heat produced will be at point of contact. This is an ideal condition for spot welding.

In Fig. 2D the resistance between copper contact electrode *b* and work *w* and electrode *a* and work *w'* is made less than that between work *w* and *w'*. As a result the greatest heat is produced at point *k* just where it is needed. When the metal in contact with the electrode *b* is in a welding state, added pressure at *b* forces the molten metals together and makes a weld at *k*.

There are three important factors in spot welding—

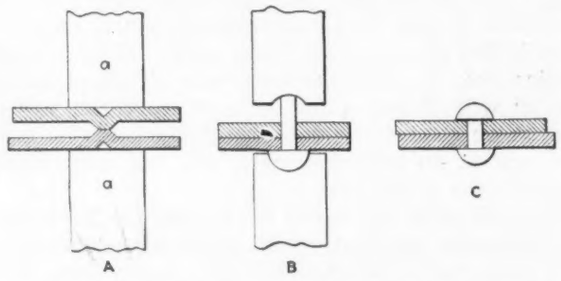


FIG. 3—PROJECTION WELDING AND RIVETING BY WELDING DEVICES

(1) clean stock, (2) pressure at weld, (3) current used —and upon these depend the time required to make a weld. The greater the pressure the less is the resistance. As the resistance becomes less more current is required to make a weld. But too light a pressure causes arcing at point of contact and work, and rusty stock may produce arcing and soon burn away the contact electrodes[1].

The pressure[2] required varies as the thickness of the

[1]See Oct. 19, 1918, issue of ELECTRICAL WORLD, page 743.
[2]See Oct. 19, 1918, issue of ELECTRICAL WORLD, page 742, Table III; page 743, last line.

work, chemical properties of material, and current used. Two pieces of No. 14 gage ordinary sheet steel, free from rust, require about 300 lb. (130 kg.) pressure at weld, and 15 kw. No. 16 gage sheet steel requires 220

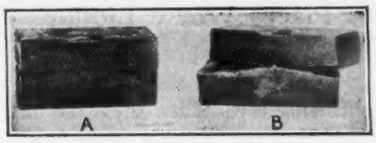


FIG. 4—HALF-INCH PLATES SPOT-WELDED

lb. (100 kg.) pressure at the weld and 12.5 kw. for $\frac{5}{16}$-in. (7.8-mm.) spot. The current flowing through the work averages 7000 amp.

Some materials that can be spot-welded are galvanized iron to galvanized iron (galvanizing will be destroyed at weld), sheet brass to sheet brass or sheet steel, German silver, zinc and nickel.

CONTACT ELECTRODE SHAPES

The different types of contact electrodes used in spot welding are shown in Fig. 2 (A, B and C). To determine the proper kind of contact electrodes to use in welding material, from No. 20 gage to No. 12 gage, a test was made by taking two machines doing the same work, one machine being fitted with contact electrodes, type B (Fig. 2), while the other machine was equipped with contact electrodes as shown in Fig. 2B. At the end of one month's run the saving in contact electrodes on the machine using the electrodes as in Fig. 2B was as much as 50 per cent, while production was speeded up about 3 per cent owing to the time saved in dressing the points of the electrode.

Fig. 2A shows the use of a contact electrode for close work, as in corners, while Fig. 2C illustrates the "button" method of spot welding. A "slug" or "button" is placed between the contact electrodes and the work.

In Fig. 3A "projection" welding is illustrated. This method of welding has proved satisfactory on small work where the projections can be made at the same

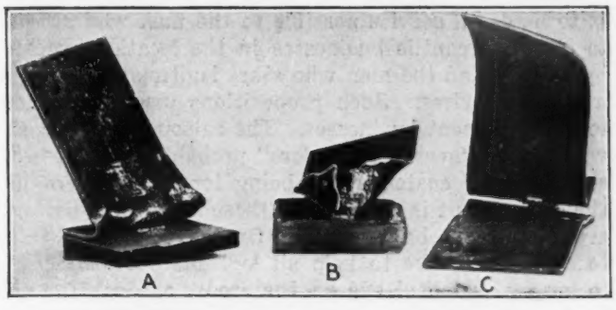


FIG. 5—EXAMPLES OF EFFECTIVE SPOT WELDING

A—No. 14 gage steel sheet welded to ¼-in. (6.3-mm.) plate
B—No. 14 gage sheet and ¼-in. (6.27-cm.) steel plate arc-welded
C—Two No. 14 gage sheets spot-welded

time material is formed or stamped, one die perform-in both operations. The method has been used in making brush holders for motors and generators.

DRIVING RIVETS WITH WELDING APPARATUS

A method of riveting plates together by means of a spot-welding machine is shown in Fig. 3B, and the finished rivet in Fig. 3C. It is successful when the ordinary 30-kw. spot welder is used, up to ⅜-in. (8.5-mm.) rivets. Rivets over this size require special apparatus as the copper-contact electrodes are too soft for upsetting the rivet. This method of riveting is ideal since the rivet is hottest where completely upset and in cooling makes a tighter joint. The method is also preferred in some instances since it is noiseless and the equipment costs less than forge and air equipment necessary to operate air guns. In some instances it has proved economical by speeding up of production over the air guns in driving rivets.

In Fig. 4A a piece of sheet steel is shown welded to a steel plate. A chisel was driven on each side of the weld, and then the spot was pulled through the sheet and the sheet drawn back, showing the weld. Fig. 4B shows another sheet and plate welded together. The piece was placed in a milling machine and cut through the center of the weld, the end being polished to show the union of metals. The No. 14 gage strip was pounded up, showing the weld to be perfect. This is conclusive evidence that it is not necessary for both pieces to be of the same thickness. In Fig. 4C are shown two pieces of No. 14 gage sheets welded with a ⅜-in. (9.5-mm.) spot.

Fig. 5 shows two pieces of ½-in. (1.27-cm.) material successfully welded, the size of spot being ⅜-in. (9.5-mm.). The piece was cut through center of weld and polished to show union of metal. Note the width of weld, it being a little under ¾ in. (1.9 cm.). Fig. 5B shows same piece after it was torn apart by driving a chisel on each side of the weld. Note how the metal is battered in tearing the pieces apart. All these pieces were welded on a 30-kw. spot welder[3]. This machine was not mechanically strong enough to press the ½-in. (1.27-cm.) pieces firmly together. The pressure exerted in this case was a little over 700 lb. (320 kg.).

The thickness of the plates that can be welded will depend upon the size and shape of material to be welded. Special machines are now being used that will weld two pieces of ¾-in. (1.9-cm.) plates, hydraulic pressure being used on the plates while heating and for forcing the molten metals together after reaching a welding heat. It is that final "squeeze" that makes a perfect weld.

[3]Oct. 19, 1918, issue ELECTRICAL WORLD, page 743, Figs. 1 and 2.

IN TURN, various groups of mining men, representing companies producing certain metals, attorneys for oil companies and executives of power companies have appeared in Washington, have carefully and patiently explained to various committees the need of constructive legislation, and in regular rotation bills have been introduced in one or both houses of Congress only to die in committee or in conference. From time to time promises of legislation have been made and Presidential messages have been written in regard to the development of power and the release of withdrawn lands. But the temporary withdrawals still stand, and the producer of power from water and the producer of power from oil are both prevented from developing the resources of the nation. This policy of repression was inconsistent and unfair before the war; it was almost fatal to the prosecution of the war, and if continued will certainly be fatal to the development of a national constructive program for peace.—*D. M. Folsom, Pacific Coast Petroleum Administrator.*

Effect of Prohibition on Lighting Revenue

Analysis of Experience of Companies in Communities Already Dry Indicate What May Be Expected to Happen After July 1 in Those Places Where Liquor Is Now Sold

WHEN the sale of liquor is stopped in a community an immediate effect is to reduce the revenue of the local central station. This reduction may range from a few per cent to 50 per cent of the lighting revenue. However, within a short period, varying from two months to a year, the loss is usually all regained. When still more time has elapsed it is discovered that the community has benefited by the abolition of the liquor trade and that the central station's revenue has increased in proportion to the general benefit which the community has received.

EXPERIENCE OF SEVENTY-FIVE CENTRAL STATIONS

The above statement summarizes the experience of about seventy-five central stations operating in several states that were voted dry at different times between the years of 1881 and 1918. The information on which the statement is based was secured by the ELECTRICAL WORLD to assist in predicting what will happen to the revenue of central stations operating in territory that is now "wet" but that will go "dry" on July 1. Some of this experience, which is given in detail in this article, may be of value also in showing methods that may be used and policies that can be adopted to shorten the period required to restore earnings to the level they had attained before the dry law went into effect.

Obviously the thing that causes the great reduction in earnings in most cities is the closing of the stores used as saloons. While saloons are not users of liberal intensities of light, they are excellent producers of revenue because they are long-hour users. It is usually agreed that, unless local laws restricting them are enforced, saloons use lamps on an average nineteen hours a day. When the saloons are permanently closed the buildings which they occupied produce no revenue until some other business is started there. It is unlikely also that any business which succeeds a saloon in a given location will be such a "long-hour user." It is probable, however, that a greater connected load will be used by the new customer. Average experience as to whether the net profit is greater in one case than in the other is difficult to secure, but it seems to be generally conceded that when the saloon locations are all taken up by other businesses the central-station lighting revenue will have returned to approximately its former proportions. It is also noticeable that companies in the larger cities seem to suffer more, proportionately, than do those in the small towns or the cities of moderate size.

In order to show how this works out under different conditions, the experiences of some of the stations which have kept records on this topic are given herewith in tabular form. The data are grouped by states because that will assist in showing more clearly how the severity of the blow caused by loss of revenue shrinks in significance as it passes into history. In Kansas, the second state to go dry, it is difficult to find companies that have records or men that remember how the revenues were affected. The experience of Kansas and Tennessee does show, however, the difficulty of enforcing prohibition laws when they are unpopular. For nearly ten years after Kansas was voted dry saloons flourished in the larger cities. In such cases the decrease in lighting revenue was deferred until the law was enforced. In states where prohibition has prevailed for years opinion is unanimous that the ultimate result of abolishing the liquor trade was beneficial to the central station. In states that went dry in 1918 the thought is expressed that the ultimate result may be beneficial, but the tone of some letters indicates that as long as store buildings are vacant the real benefits cannot clearly be seen. It is distinctly noticeable, however, that where two or three years of experience in dry territory has fallen to the lot of a public utility executive he becomes an ardent advocate of prohibition for business reasons, regardless of his personal inclination.

Certain types of business always show activity during the period of transition from saloons to other customers. It seems generally conceded that with the abolition of saloons there have been increases in the demand for house-wiring among working people. Electrical devices have been easier to sell. Collections of electric service accounts have been better. Better lighting fixtures and different types of fixtures and reflectors, particularly those used in poolrooms and restaurants, are sold to replace types used in saloons. Places of legitimate amusement have flourished and increased in number. While the readjustment is being made, however, central-station revenues suffer. To make this period of transition as short as possible has been the aim of central-station sales departments in some of the states already dry.

One of the methods that seem to assist in this work is to be of all service possible to the men who attempt to start mercantile businesses in the locations vacated by saloons and the men who start legitimate entertainment enterprises. Such propositions usually turn out to be permanent businesses. The saloons that are converted into "near-beer parlors" probably come as close as any other customers to being long-hour users like the saloons, but in many cases these "near-beer parlors" are reported to be poor pay. On the whole, the thing to do seems to be to help all legitimate ventures and to keep a watchful eye on the credit of doubtful new businesses.

TESTIMONY FROM THE DRY STATES

To show what some of the men in the public utility business in dry states think about the situation now faced by operators in wet states some quotations are given from letters received by the ELECTRICAL WORLD. The general manager of an Indiana company wrote:

"I have had the unique experience of operating plants in four cities, in three different states, at times when the towns were wide open when I went to them and either the town or state went dry within two years after I took charge of the properties. When I say wide open I mean very wide open, with saloons in a ratio of one to every 300 of population and all that

goes with it. My experience in none of the above cases has been that the business of selling either gas, electricity or street-railway transportation has been adversely affected by the communities going dry. As a matter of fact, if there was any effect noted, it would be a favorable effect."

All of the four cities mentioned by this Indiana manager are thriving communities of from 10,000 to 100,000 people in the Middle West and South. Moreover, something of the same thought is expressed in a letter from the president of a company in a prosperous city in Michigan. He said:

"Our eight years' experience as a dry city shows that there is a big change for the better, and the utility has received its share. With a nearly stationary population, our residence and commercial light earnings have increased just about 50 per cent and the number of light meters has increased 80 per cent. The general tone of business is much better than before, and dependency and crime are greatly reduced. Bank deposits have more than doubled; the tax rate is no higher than it was when we were getting the saloon revenue. All of our reputable business men are a unit in declaring that nothing could induce them to go back to saloons, and I figure that where such conditions exist it is the utility's own fault if it does not share in the increased prosperity."

TABLE I—DATA ON REVENUES FROM LOCATIONS IN SEATTLE OCCUPIED BY SALOONS PRIOR TO THE PASSAGE OF THE PROHIBITION LAW IN THE STATE OF WASHINGTON

Address	Class of Business	Yearly Revenue	Hours Run per Month	Maximum Demand, Kw.
716½ First Ave.	Saloon	$289.10	400	4.5
	Poolroom	446.90	400	5.2
709 First Ave.	Saloon	647.00	400	7.0
	Amusement parlor	378.50	530	3.9
S.W. cor. 1st and Seneca	Saloon	365.05	480	4.0
	Soft-drink parlor	332.15	320	4.0
405 Pike	Saloon	404.35	350	4.3
	Meat market	463.55	400	5.3
111 First South	Saloon	241.45	500	2.5
	Café	213.50	650	2.2
200 Second South	Saloon	293.15	320	3.5
	Cigar stand	296.45	320	3.5
214 Jefferson	Saloon	403.45	220	5.2
	Barber shop	358.20	300	4.7
117 Washington	Saloon	174.00	600	2.0
	Restaurant	301.85	650	4.0
157 Washington	Saloon	309.95	260	3.7
	Clothing store	153.50	300	2.0
219 Union	Saloon	379.85	340	4.3
	Refreshment parlor	416.20	260	5.0
323 First South	Saloon	214.10	310	2.5
	Express and cigars	95.10	190	0.8
112 First South	Saloon	235.90	370	2.7
	Soft drinks	84.80	320	1.0
1609 First Ave.	Saloon	480.60	200	6.0
	Poolroom and billiards	131.70	260	1.8
820 Second Ave.	Saloon	295.90	480	3.2
	Stationery company	279.00	240	3.7
1315 First Ave.	Saloon	412.45	350	5.3
	Lunch and soft drinks	190.70	450	2.0
1119 First Ave.	Saloon	257.60	340	2.8
	Soft-drink parlor	49.25	380	1.6
1214 First Ave.	Saloon	271.70	435	2.7
	Cards and poolroom	212.70	190	3.0
1222 Second Ave.	Saloon	539.80	550	5.2
	Jeweler and boot shop	271.00	240	3.5
5231 Ballard	Saloon	153.25	200	1.8
	Soft-drink parlor	172.40	260	2.5
5129 Ballard	Saloon	205.50	200	2.6
	Soft drinks	94.70	150	1.6

	Average Kw.-Month Rate	Average Yearly Revenue	Average Hours Run per Month	Average Maximum Demand, Kw.
Saloons	7.25	$328.67	365½	3.8
Miscellaneous	6.80	252.13	340½	3.1

Managers of some companies have collected data on certain phases of the wet and dry question as it affects the electric service business. For instance, the Detroit Edison Company made a canvass the day before the saloons in Michigan closed to see what kinds of business the city's 1600 saloon keepers would undertake. The results of this investigation (given in Table II) showed that soft-drink places predominated. Observation of conditions since that time, however, show that the soft-drink places are not all proving profitable and some are going out of business or are starting other businesses.

The city electric light department of Seattle, Wash., made an investigation to determine the comparative characteristics of saloon loads and the loads of business that followed saloons in the same locations. The average yearly revenue from the saloons investigated was $328.67, as against $252.13 from the businesses that succeeded them. The number of hours' monthly use was 365.6 and 340.5 respectively, while the average maximum demand was 3.8 kw. and 3.1 kw. The data from Seattle are given in detail in Table I. A survey of these figures might be taken to indicate that with some sales efforts the lighting intensities could be improved with profit both to the customers and to the city's lighting department.

The Gary (Ind.) Heat, Light & Water Company made an interesting analysis of conditions in that Hoosier steel center, where the large percentage of foreign population made the saloon business an important part of the city's retail businesses. While these figures may not be conclusive owing to the short time Gary has been dry (since April 2, 1918), they at least indicate what happens under such conditions.

The consumption for January and February, 1918, of fifty-five saloons selected at random in Gary was 16,440 kw.-hr., and for the same period of 1919 it was 9730 kw.-hr., a decrease of 41 per cent. There were seventeen lightless nights in January and February, 1918, and increasing 1918 consumption to allow for decrease due to this fact, the apparent decrease of 1919 over 1918 will be approximately 55 per cent. By actual demand test on a block which was composed entirely of saloons on the lower floors and generally of rooming houses above the demand dropped from 29 kw. while wet to 18 kw. about ten months after the dry law went into effect, a reduction of about 38 per cent. Comparing the percentage of reductions in demand and consumption, there is apparent a considerable decrease in average hours' use.

Nearly all managers who have operated properties in cities that have been dry for a few years speak of the increased revenue from residential customers of the working class. Their impressions in this respect are necessarily more or less general. However, some information that has a specific bearing on the subject has come from the Ware County Light & Power Company of Waycross, Ga. R. E. Tresher, assistant treasurer of the company, writes:

"We have always been under the impression that moving-picture theaters were high-class revenue producers in that they paid comparatively large bills. We recently discovered during two 'flu' bans that our peak load was considerably higher with theaters, etc., closed. This is simple when we consider that 300 to 500 families at home would certainly consume more light than would be consumed by a theater which they might attend for from one and one-half to three hours."

Companies operating in resort cities naturally expect to suffer. Some may suffer, but there is consolation for many of them in what W. H. Plummer of Asheville,

TABLE II—DETAILS OF CONDITIONS FOLLOWING PROHIBITION REPORTED BY FORTY-ONE LIGHTING COMPANIES

Name of Company and Date State Went Dry	How Did Closing Saloons Affect Company's Revenue	Rate of Growth of Lighting Business Before and After State Went Dry	Number of Saloon Customers Prior to Dry Period	Types of Customers Replacing Saloons in Locations Vacated	Estimated Average Hours' Use of Light in Locations Vacated by Saloons	Increase or Decrease in Revenue from These Locations	Effect on Show-Window Business	Remarks
Atchison (Kan.) Ry., Lt. & Pwr. Co., 1881, enforced 1902	Favorably	.....	35	Various, all filled	.....	Decreased	Increased	Easier to sell service, easier to collect bills
Leavenworth (Kan.) Lt., Ht. & Pwr. Co., 1881; enforced, 1908	Increased	1906, $141,200; 1907, $193,800; 1908, $192,500; 1909, $210,10o; 1910, $246,800	110	All sorts	.....	Increased	Increased	.....
Augusta (Ga.) - Aiken Ry. & Elec. Corp., 1908; enforced 1917	Decreased for few months, then increased	Increase in revenue and customers prior to 1917, 8 per cent per annum; since then, 11 per cent	100 total, 15 large ones	Dry-goods, cigar stores, automobiles, groceries, drugs	Winter, three hours maximum demand, nine hours part load	Increased 15 per cent	(1) Increased materially	.....
Athens (Ga.) Ry. & Elec. Co., 1883	Not at all	No effect	7	Poolrooms, dry goods, fruit and soda stands	.....	No effect	None	.....
Durham (N. C.) Tract. Co., 1909	Increased revenue from light, ice and traction business	.....	21	Various	Smaller	Decrease at first, then increase	(2) Better	Better domestic conditions
Potomac Elec. Pwr. Co., Wash., D. C., 1917	Decrease $50,000 to $60,000 a year	.....	350	Lunch rooms, delicatessen, cigar stores, small goods stores	3	Decreased $50,000 to $60,000 a year	Decreased	.....
Corsiciana (Tex.) Gas & Elec. Co., 1909	Temporary decrease	.....	15-20	Groceries, dry goods, fruit, candy, pool halls, soft drinks	Shorter	Decreased	(3) Increased	Net effect is increase because of more revenue from homes
Brush Elec. Co., Galveston, Tex., 1918	Adversely	.....	158	Soft drinks	.....	Decreased 50 per cent	Decreased	.....
American Pub. Serv. Co., Dallas, Tex., 1918	Not noticeable	.....	.....	.....	.....	.....	.....	.....
Fort Worth (Tex.) Pwr. & Lt. Co., 1918	Not noticeable	.....	.....	.....	.....	.....	.....	.....
Eastern Tex. Elec. Co., Beaumont, Apr., 1918	Counterbalanced by general prosperity of city	1916, 10 per cent; 1917, 15 per cent; 1918, 15 per cent	70	Restaurants, soft drinks	5	Decreased 10 per cent to 15 per cent	(4) None	
Texas Pwr. & Lt. Co., Dallas, 1918	Temporary decrease 10 per cent	10 per cent a year until 1918	500, one saloon for every 100 customers	Soft-drink stands, pool halls, picture shows	50 per cent of saloon figure	Temporary decrease, 10 per cent	None	Net result, company did not suffer
An Iowa company, July, 1911	Decrease of $4,000 to $5,000 from light and steam heat	.....	22	.....	.....	Temporary decrease, gain in residence customers	.....	Saloon locations on side streets slow to come back as customers
Clinton (Iowa) Gas & Elec. Co., 1916	Increased	10 per cent	29	All kinds	Same	Increased	.....	.....
Citizens' Gas & Elec. Co., Waterloo, Ia., 1916	Increased generally	.....	26	Soft drinks	One-third former amount	Temporary decrease, $3,600 a year	Decreased	Credits better
An Iowa company, 1916	Change made gradually by reducing number of saloons. Shows some decrease	.....	100	Pool halls, barber shops, soft drinks	Less	Temporary decrease	None	.....
Citizens' Gas & Elec. Co., Council Bluffs, Ia., 1916	Not noticeable	.....	29	Merchandising, soft drinks	Same	Increased 10 per cent	No	Merchandising and credit conditions improved
An Iowa company, 1916	Increased	.....	47	Restaurants	Longer	Same	No	.....
Jackson (Tenn.) Ry. & Light Co., 1909	Temporary decrease	.....	46	.....	.....	Decreased 10 per cent	No	In long run company benefited
Memphis (Tenn.) Gas & Elec. Co.; enforced, June, 1914	$36,000 decrease on annual basis, locations vacant six months to year	.....	400	Good class of stores	.....	Decrease	No	Net result is betterment
A Tennessee company, 1907	.....	Per cent increase: 1906, 23; 1907, 20 1908, 3; 1909, 4.	115	Motion-picture shows, drug-stores, poolrooms, etc.	6	Decreased temporarily	No	Effect of 1907 depression marked
Miami (Fla.) Elec. Lt. & Pwr. Co.	Not noticeable after 60 days	.....	20	Soft-drink and other stores	5 to 7	Increase, due to growth of town, 400 per cent	No	.....
Washington Water Pwr. Co., Spokane, 1916	Slump for first month after closing	.....	270	Every class of business	About the same	Not much change	No	.....
Ltg. Dept., Seattle, Wash., Jan., 1916	Increased	Total revenue: 1914, $1,048,393; 1915, $1,-063,730; 1916, $1,-206,695; 1917, $1,-328,647	Total 300, 150 on city lines	Show stores, cigar stores, poolrooms, restaurants, clothing stores, barber shops, soft drinks	340 hours per month	Slight decrease	No	Conditions so much better, want to forget saloon days
Puget Sound Trac., Lt. & Pwr. Co., entire territory, part 1912, part 1916	Increase in some places, decrease in others	.....	.....	Amusement places, merchandising establishments	.....	Temporary decrease	No	Abolition of saloons a distinct aid to business
Bellingham, Wash.	Temporary decrease 8 per cent	.....	40	Cigars, billiards, dry goods	Same	Increased	No	.....

TABLE II—DETAILS OF CONDITIONS FOLLOWING PROHIBITION REPORTED BY FORTY-ONE LIGHTING COMPANIES—Continued

Name of Company and Date State Went Dry	How Did Closing Saloons Affect Company's Revenue	Rate of Growth of Lighting Business Before and After State Went Dry	Number of Saloons Customers Prior to Dry Period	Types of Customers Replacing Saloons in Locations Vacated	Estimated Average Hours' Use of Light in Locations Vacated by Saloons	Increase or Decrease in Revenue from These Locations	Effect on Show-Window Business	Remarks
Detroit (Mich.) Edison Co., May, 1918	.....	.....	1600	Immediate result: 69 per cent soft-drink places, 6 per cent other business, 3 per cent undecided, 22 per cent out of business	.....	Decreased	Better	Soft-drink places changing to other stores
Michigan city of about 25,000, 1918	Approximately $4,000 decrease first year	.....	46	Soft-drink places	3	Decreased 60 per cent	Not much	.....
Citizens' Lt. & Pwr. Co., Adrian, Mich., 1910	Decreased temporarily, increased thereafter	Per cent: 1908, 2 per cent; 1909, 3 per cent; 1910, 2.6 per cent; 1911, 6.6 per cent	32	Shoe stores, soft drinks, groceries, lunch rooms	About half former	Decreased 40 per cent	(•) Tended to reduce hours of business, but standards of intensity increased	.....
Bay City (Mich.) Elec. Lt. Dept., 1918	$1,000 decrease per annum	.....	400	Soft drinks	Same	No change	Increased	.....
A Michigan company	Decreased for 60 days	10 to 12 per cent per year steadily	35	Everything from soft drinks to millinery	.....	Decreased 50 per cent	Increased very much	Decreased railway excursion business
Sault Ste. Marie (Mich.) Elec. Co., 1918	Slight decrease	.....	25	Soft drinks	Same	About same	(•) More light used	.....
An Indiana city of 100,000, 1918	Decrease $8,500 annually	11 per cent increase was growth before prohibition; since then there is 1 per cent decrease	275	Restaurants, soft drinks, 63 still vacant	1800 hours per year	Total revenue decreased 20 per cent	(•) Some signs discontinued	.....
Indiana General Service Co., Muncie, closed three times and opened again	No effect after 60-day slump	No effect on any occasion by loss of saloon business	26	Various	.....	No change	No	.....
Northern Ind. Gas & Elec. Co., Hammond, May, 1918	Effect of decrease for only six or eight months	.....	450	Soft drinks, mercantile stores	70 per cent of saloon business	Decreased	No	Feel that ultimate effect will be beneficial
Hydro Elec. Lt. & Pwr. Co., Connersville, Ind., May, 1918	Slightly less	.....	25	All kinds	.....	Slight decrease	No	Collections better, workmen better satisfied
Huntington (Ind.) Lt. & Fuel Co.	All saloons used gas lights	.....	13	Soft drinks	.....	Decreased	No	.....
Ind. Ry. & Lt. Co., Kokomo	Slight temporary decrease in commercial business and immediate increase on residential revenue	.....	30	Mercantile	.....	Increased	(•) No	.....
Merchants' Ht. & Lt. Co., Indianapolis, 1918	Some decrease	.....	Only a few of the city's saloons	Soft drinks	.....	.....	No	.....
Ladianapolis (Ind.) Ht. & Lt. Co., May, 1918	Decrease $25,000 per year	Per cent: 1917, 21½; 1918, 26‡.	660 total, 370 on company's lines	Mercantile business	Less	Decreased 33 per cent	Sign business decreased	.....
Gary (Ind.) Ht., Lt. & Water Co., 1918	Decreased	.....	150	Pool and billiard halls, groceries, produce markets, soft drinks	50 per cent of saloon business	Decreased 55 per cent	Sign lighting decreased	.....

(•) Residential business increased while income from breweries converted into soft-drink factories was doubled. (•) More lighting in homes. (•) Y. M. C. A. and Elks' Club lighting increased. (•) Small loss in fan business. (•) Residence lighting and house wireing increased. (•)Average income per lighting customer increased. (•) Loss from social clubs lighting revenue, $2,000 per year. (•) Increased rate of residential growth.

N. C., has said: "As you know, Asheville is one of the most popular and attractive resort places in the United States, and we felt that when prohibition came it was going to affect us adversely. The contrary has been the result."

M. C. Linn, general manager of the Des Moines (Iowa) Electric Company, wrote: "I have had experience in several communities and believe from that experience that the loss of revenue is only temporary in any community. All saloon buildings are gradually taken up by different lines of business, and the average community should recover in the course of a year or a year and a half."

While general collections as a rule are better for the absence of saloons, the ability of cities and towns to pay for street lighting is sometimes temporarily impaired. This may necessitate carrying street-lighting accounts for a period. A. C. Marshall of Detroit, whose company serves a large number of dry towns, summarized this situation:

"Some of the smaller villages in our territory experienced a slight financial stringency in the first months after the state went dry. This lasted only until the next tax money was received, and since that time we have noted no difference in our collections. In the larger part of the municipalities served by us, fully 75 per cent, there was no difference."

To summarize the data and impressions on this topic it seems fair to say that the immediate effect is a slump in lighting revenue as the saloons close. Then business picks up again as the saloon locations are reoccupied. The greater buying power of the working people soon makes itself felt in several ways, and the final result is beneficial to the electric company and the community. Any work that sales departments can undertake to assist in making the transition from saloons to other permanent businesses seems to be worth while as it shortens the period of depression.'

Census Report on Electric Central Stations

Government Returns for 1917 Show that Output of Energy in That Year Was More than Double That for 1912 and More than Quadruple the 1907 Total—Aggregate Income, $526,000,000

ACCORDING to a report about to be issued by Director S. L. Rogers of the Bureau of the Census, Department of Commerce, the electric light and power stations in the United States during the year 1917 generated more than 25,000,000,000 kw.-hr. of electrical energy, producing an income of more than $500,000,000, and gave employment to more than 100,000 persons, whose salaries and wages aggregated nearly $100,000,000. The output in 1917 was more than double that for 1912 and more than quadruple the output for 1907.

This report, which was prepared under the supervision of Eugene F. Hartley, chief statistician for manufactures, covers both commercial and municipal plants, but does not cover electric plants operated by factories, hotels, etc., which generate energy for their own consumption, plants operated by the federal government and state institutions, nor plants that were idle or in course of construction.

The figures show great strides in the industry during both of the five-year periods 1907-12 and 1912-17. The output of electrical energy by the light and power stations increased at a considerably greater rate and their expenses at a slightly greater rate than their income, 95.3 per cent represented electric service, amounted to $526,886,408, an increase of 74.3 per cent as compared with 1912 and of 200 per cent as compared with 1907. The total expenses were $427,136,049, or 82.1 per cent more than in 1912 and 218.3 per cent more than in 1907. The employees of the light and power stations numbered 105,546, an increase of 33 per cent over 1912 and of 121.6 per cent over 1907, and their salaries and wages aggregated $95,239,954, an increase of 55.7 per cent as compared with 1912 and of 168.9 per cent over 1907.

The total primary power in 1917 amounted to 12,857,998 hp., an increase of 70.8 per cent as compared with 1912 and of 213.7 per cent over 1907. Of this power nearly two-thirds—8,389,389 hp.—was derived from steam; almost one-third—4,251,423 hp.—from water, and the remainder—217,186 hp., or less than 2 per cent—from internal-combustion engines. The corresponding proportions for 1912 and 1907 differed but slightly from those just stated. The average horsepower per steam engine shows a very great increase—from 334 in 1907 to 631 in 1912 and to 1124 in 1917. The average horsepower of the waterwheels also shows a marked increase from census to census, but in the

CENSUS BUREAU REPORT OF ELECTRIC LIGHT AND POWER STATIONS IN THE UNITED STATES—1917

	1917	1912	1907	Per Cent of Increase (*) 1907 to 1917	1912 to 1917	1907 to 1912
Number of establishments	6,541	5,221	4,714	38.8	25.3	10.8
Commercial	4,224	3,659	3,462	22.0	15.4	5.7
Municipal	2,317	1,562	1,252	85.1	48.3	24.8
Income	$526,886,408	$302,273,398	$175,642,338	200.0	74.3	72.1
Electric service	$502,100,346	$287,138,657	$169,614,691	196.0	74.9	69.3
All other	$24,786,062	$15,134,741	$6,027,647	311.2	63.8	151.1
Total expenses, including salaries and wages	$427,136,049	$234,577,277	$134,196,911	218.3	82.1	74.8
Number of persons employed	105,546	79,335	47,632	121.6	33.0	66.6
Salaries and wages	$95,239,954	$61,161,941	$35,420,324	168.9	55.7	72.7
Total horsepower	12,857,998	7,530,044	4,098,188	213.7	70.8	83.7
Steam engines:						
Number	7,464	7,847	8,054	-7.3	-4.9	-2.6
Horsepower	8,389,389	4,949,778	2,693,273	211.5	69.5	83.8
Internal-combustion engines:						
Number	2,946	1,116	463	536.3	164.0	141.0
Horsepower	217,186	111,035	55,828	289.0	95.6	98.9
Waterwheels:						
Number	3,357	2,939	2,481	35.3	14.2	18.5
Horsepower	4,251,423	2,469,231	1,349,087	215.1	72.2	83.0
Kilowatt capacity of dynamos	9,001,872	5,165,439	2,709,225	232.2	74.3	90.7
Output of stations, kilowatt-hours	25,438,611,417	11,569,109,885	5,862,276,737	333.9	119.9	97.3
Stationary motors served:						
Number	554,817	435,473	167,184	231.9	27.4	160.5
Horsepower	9,216,323	4,130,619	1,649,026	458.9	123.1	150.5
Number of street lamps:						
Arc	256,838	348,643	(†)	—	-26.3	—
Incandescent, etc	1,389,382	681,957	(†)	—	103.7	—

*A minus sign (-) denotes decrease. † Not available.

and the rate of increase in the number of persons employed was much smaller, particularly during the later five-year period, than that in the amount of business.

The total number of establishments increased from 5221 in 1912 to 6541 in 1917, the latter comprising 4224 commercial and 2317 municipal establishments. The increase indicated by these figures is somewhat misleading, since 2296 new establishments came into existence between 1912 and 1917, but as a result of combinations in the commercial systems and various other changes, the net increase was only 1320, comprising 565 commercial and 755 municipal stations.

The total income of the stations in 1917, of which case of the internal-combustion engines there has been a decline.

The total dynamo capacity, 9,001,872 kw. in 1917, represents an increase of 74.3 per cent as compared with 1912 and 232.2 per cent over 1907, these rates of increase being slightly greater than the corresponding ones for total primary power. The output of electrical energy aggregated 25,438,611,417 kw.-hr., an increase of 119.9 per cent for the period 1912-17 and of 333.9 per cent for the decade. Of the 6541 establishments reported for 1917, those which purchased all their electrical energy from other establishments numbered 1422, as against 507 in 1912 and 227 in 1907.

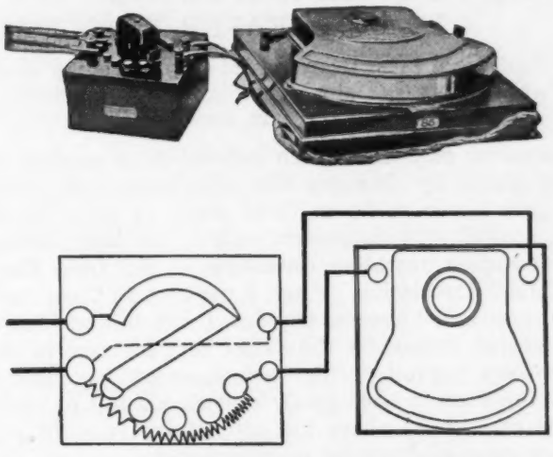
STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

MULTI-RANGE AMMETER WITH EXTERNAL SHUNTS

Laboratory-Type Millivoltmeter Arranged with Five-Tap Shunt, of Which Any Tap Can Be Brought Into Main Circuit by Handle

For the measurement of the current employed in photometric tests of incandescent lamps, in magnetic tests of iron bars and in the lamps of optical pyrometers, the Electrical Testing Laboratories, New York City, have developed a multi-range ammeter which consists of a millivoltmeter with a five-tap shunt controlled by a handle. The accompanying diagram shows the circuit connections of the apparatus, which embodies the principle of the Ayrton universal shunt. As the handle is turned from the shunt of lowest resistance and largest current range, the various shunts which are connected in series and which up to that instant have constituted a part of the series resistance of the instrument circuit are transferred to a position in the main line.



PHOTOGRAPH AND DIAGRAM OF INSTRUMENT WHICH EMBODIES THE PRINCIPLE OF THE AYRTON SHUNT

The apparatus illustrated herewith allows ranges of 0.75, 1.5, 3, 7.5, and 15 amp. when connected to a meter having a 200-millivolt range and a resistance of about 8 ohms. An unlimited number of uses can be found for this method, because it can be extended for building shunts of about 500-amp. range.

The rotating multiple-leaf contact blade is made broad enough to bridge the gap between the contact studs so that the main-line circuit can never be opened. Shunt adjustment by comparison with a standard ammeter is somewhat tedious but not at all difficult since the resistances of the various steps desired can be readily computed. It is probably easier, however, to adjust each shunt by comparison with a standard resistor using the Kelvin double-bridge method. Obviously the contact resistance of the rotating switch does not affect the accuracy of the indications of the instrument.

This information was contributed by Gordon Thompson of the Electrical Testing Laboratories.

ELECTRIC BRASS FURNACES DISPLACE OTHER TYPES

One Company Uses 2500 Kw. for Melting in Three-Phase Furnaces, Another Requires 800 Kw. for One-Phase Induction Furnaces

Brass manufacturers who recently met in the convention of iron and steel electrical engineers at Pittsburgh said that they knew from experience that there are now electric brass furnaces whose metallurgical efficiency justifies their use in preference to fuel-fired furnaces. W. R. Clark, works manager of the Bridgeport (Conn.) Brass Company, spoke on the experience of his company, which has in operation a total of 800 kw. in the Ajax Metal Company's "Wyatt" single-phase, 60-cycle induction furnaces melting brass. He said that the largest furnace has a demand of 75 kw. at 75 per cent power factor, and its pouring capacity is from 500 lb. to 600 lb. (340 kg. to 290 kg.) per hour. These furnaces have melted and poured from 6 lb. to 9 lb. (2.7 kg. to 4.1 kg.) of brass per kilowatt-hour, and the linings are being used for as many as 2000 heats each. A 75-kw. rating is not the largest for which this type of furnace can be built, but when designed for 60-cycle operation the power factor drops rapidly with increased size. The induction furnace is found to have the advantage of heating the bath from within, automatically stirs the molten metal and has very little tendency to give off spelter. However, the furnace is limited in size and has the disadvantage that it must be started with molten metal from another furnace. This latter characteristic is more of a drawback in a foundry than in a brass mill.

The Bridgeport (Conn.) Brass Company is increasing its electric melting capacity by the addition of a 1-ton (900-kg.) "Detroit" rocking-type brass furnace which has opposed arcs from electrodes entering through the center of an oscillating drum. The voltage across the arc is 65, and the maximum demand is from 250 kw. to 300 kw. per ton. This furnace is expected to melt a ton of brass with from 225 kw.-hr. to 300 kw.-hr. of energy. The higher consumption is for mixtures high in copper, which require a greater temperature.

It was stated in an informal discussion after the close of the meeting that whereas oil-fired furnaces are limited to a capacity of about 1000 lb. (450 kg.) of brass each, there are now in operation "Bennett" three-phase brass furnaces with capacities up to 5 tons (4500 kg.) of brass each. These furnaces have not yet been placed on the market, but there was said to be an installation in actual operation aggregating some 2500

kw. demand. The demand of these furnaces is about 150 kw. and the energy consumption 300 kw.-hr. per ton. These figures are for the net amount of metal poured, not charged, and include the transformer losses, the energy for the furnace auxiliaries and the losses due to the shut-downs on holidays and week-ends.

The cost of power in melting brass is too small an item relatively to be considered, the brass men agreed. The quality of the mixture and the spelter loss determine the value of an electric furnace to a brass operator. It is known that electric furnaces have cut the spelter loss to but a fraction of the loss in oil-fired furnaces, but owing to the absorption of the furnace lining it is difficult to calculate exact values. It is this absorption of zinc and lead that limits the useful life of the furnace lining. One per cent of all the metal poured is often reclaimed out of the furnace lining.

One of the engineers said that the spelter loss depends to a large extent on the mixture used. Some electric furnaces which can melt red brass successfully cannot melt brass containing zinc without an excessive metal loss. One large Eastern brass mill which uses over 160 different mixtures is experimenting to find the type of furnace in which each mixture can be melted to the best advantage. It will probably be two years, however, before the investigation is complete. The same company is also looking into the labor requirements of the different furnaces.

It was stated that the large electric brass furnaces are conducive to better working conditions. There is less but more interesting work for the operator, and this makes it easier to attract high-grade men, who will be able to carry out the specific instructions which can be given when electric brass furnaces are used.

DATA ON INSTALLATION OF INDUCTION MOTORS

Western Association of Electrical Inspectors Adopts Standard Sizes of Conductors and Fuses for Induction Motors

The National Electrical Code does not specify the size of wire which should be used to connect up any given motor, nor does it give the sizes of starting and running fuses to be used. A committee of the Western Association of Electrical Inspectors therefore compiled tables based on the code rules which give this much-needed wiring information for single-phase, two-phase and three-phase motors. Excerpts from the report and the recommendations for three-phase motors follow:

SQUIRREL-CAGE THREE-PHASE INDUCTION MOTORS EQUIPPED WITH COMPENSATORS

Average Hp.	Full-Load Amp. 220 Volts	Full-Load Amp. 550 Volts	Starting Fuse Amp. 220 Volts	Starting Fuse Amp. 550 Volts	Running Fuse Amp. 220 Volts	Running Fuse Amp. 550 Volts
0.5	1.8	0.7	5	5	5	5
1	3.5	1.3	10	5	5	5
2	6.5	2.6	20	10	10	5
3	9.5	3.8	30	10	15	5
5	15.4	6.2	40	15	20	10
7.5	22.4	9	60	25	25	15
10	29	11.8	70	30	35	15
15	42.5	17.4	85	40	45	20
20	55	22.5	110	55	60	25
25	68	27	140	65	75	30
30	80	32	160	70	90	35
35	94	37	190	75	110	40
40	105	42	210	85	115	45
50	130	52	260	110	145	60
60	155	62	310	125	170	70
75	192	77	390	160	210	85
100	252	101	500	200	280	110
150	368	148	730	300	410	160
200	484	195	920	390	530	215
250	595	240	1200	480	650	265
300	710	285	1420	570	780	31[illegible]

No consideration was given to limiting the voltage drop at the motor. Motors without a starting device and those operating at less than 600 r.p.m. require, in the majority of cases, one size larger wire or cable than the table calls for. The wires in the table are calculated for two and one-half times the full load current of motors up to 30-amp. rating and for twice the full-load current of larger motors.

Wire or cable sizes for other types of continuous-duty induction motors should be based on the following multiples of the full-load current: Squirrel-cage motors up to 7.5 hp. without starters, three times full-load current; squirrel-cage motors with star-delta starting switch, one and a half times full-load current; wound-rotor motors with resistance in rotor, one and a tenth times full-load current, and single-phase repulsion motors up to 15 hp., twice, and single-phase motors with split-phase starting, three times full-load current.

THREE FIREMEN ARE FOUND TO BE CHEAPER THAN TWO

Sufficient Coal Has Been Saved by Changing from Twelve-Hour to Eight-Hour Shifts to More than Pay the Increase in the Payroll

Operating costs have been reduced in a number of power plants by changing the boiler-room crew from two twelve-hour shifts to three shifts of eight hours each, according to statements made at the last meeting of the station operating committee of the Ohio Electric Light Association. From 5 per cent to 7 per cent of the entire fuel expense was saved, and this was more than enough to pay for the 50 per cent increase in the boiler-room payroll. This saving cannot be effected when the firemen handle only a small amount of coal; in the cases cited above the cost of fuel was 70 per cent or more of the total operating costs.

However, cost is not the only consideration. Those who have had experience with both two and three shifts say that the eight-hour day makes working conditions easier and reduces the labor turnover. Furthermore, it attracts a better grade of fireman, and as a result the proper boiler pressure is maintained more constantly and the service is improved.

Unit-Cost Estimates for Small Hydro Plants

The high cost of fuel is causing the investigation of many small water-power possibilities, and the following data from an estimate of the construction cost of a 180-kw. installation in Massachusetts are suggestive. The total estimated cost of the development was $50,000, or about $277 per kilowatt (March, 1919, prices). The unit costs in the estimate included:

Earth excavation, per cubic yard	$1.50
Ledge excavation, per cubic yard	4.00
Two 90-kw. generators, per kilowatt	40.00
Installation of generators, per kilowatt	8.33
Two 42-in. turbines, 21.4-ft. head, per kilowatt of plant generating capacity	38.80
Installation of turbines, per kilowatt plant generating capacity	8.33
Gates and racks, per kilowatt	2.78
Concrete wheel casing and draft tube installation, per kilowatt	5.55
Power plant building, per square foot (brick)	6.00
Concrete canal and forebay, per kilowatt	28.80
Concrete penstock (length 740 ft., inside diameter 5 ft. 6 in.), per kilowatt	55.50
Engineering and incidentals	24.50

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

EFFICIENCY MEETINGS FOR COMPANY EMPLOYEES

Texas Company Handles This Work by Bringing Together Department Members for the Purpose of Discussion

Employees of the Texas Power & Light Company have inaugurated a series of efficiency meetings. The objects of the meetings are (1) to discuss how to do every duty with the least possible effort, (2) to learn how to coöperate with other employees, and (3) to discuss safety for the employees. These meetings are being held by departments. Thus at the meeting of the members of the commercial department the following special topics were discussed and in a number of instances new and better ways of conducting the company's business were decided upon: Handling of telephone calls; handling and filing of orders; time for securing information from new customers; handling complaints; daily balance of customers' ledgers; "disconnects" of customers leaving town; handling of old balances in customers' ledgers and deposit reserve accounts; safety first; merchandising; routing list; delinquent accounts, and miscellaneous discussion.

A STUDY OF SERVICE EXTENSION POLICIES

State Commission Rulings on Extensions Public Service Corporations Shall Make Gratis and What They Shall Charge in Other Cases

A. J. Geodjen, statistician of the Wisconsin Public Service Company, Milwaukee, recently made a study of service extension policies laid down by state commissions. He found several different service extension methods and rules employed by commissions, among which the outstanding ones follow: First—Deposits made by consumer toward construction of an extension considered strictly as a loan, the utility to refund a percentage of the revenue received monthly from the extension and to refund the entire loan with interest within five years. Second—The Illinois pre-war rules granting each consumer a two-pole extension. If extension is beyond two poles per consumer, a deposit is made covering the balance. For each consumer added within ten years a refund of the equivalent of a free extension is made. The total refund shall not exceed the original deposit and no interest is to be paid. Third—The Indiana rules, similar to the Illinois rules except that the allowable free extension is equal in amount to twice the estimated yearly revenue. No interest is paid. Fourth—In various specific cases the consumer is required to guarantee a yearly revenue in excess of the ordinary minimum charges in order to give the utility some assurance of results. The term of this protection to the utility is sometimes short and sometimes indeterminate. Although frequently used in individual cases, to Mr. Geodjen's knowledge there are no cases where this method has been used in a general rule covering all extensions a utility may be called upon to make.

This whole subject was covered in detail by Mr. Geodjen in a paper recently read before the Wisconsin Electrical Association. After making this summary the author expressed his preference for the Indiana commission's rule for the following reasons: (1) That every consumer may have a free extension in proportion to the estimated revenue. (2) This free extension can be operated by the utility without loss. (3) The consumer takes the risk in that part of the investment not warranted by revenues at the beginning of the extension. (4) The utility assumes additional investment in the line if within ten years other consumers are added to the lines. This makes the original depositor finally sacrifice only that part of the entire investment in the line which is not warranted by the revenues from the line after ten years of development. (5) Adjustment in rates or variation in construction costs are automatically included in the calculation. (6) Utility's capital account will not be likely to be overloaded by unprofitable investments.

In the discussion B. F. Lyons of Beloit stated that commissions evidently discriminate against the present customer of the utility company in favor of the prospective customer by making the returns on the investment from an extension pay only common interest rates, whereas they are willing for the general run of business of the company to pay around 8 per cent. He expressed the belief that the present high cost of money should be taken into consideration in fixing this charge. It was also suggested in the discussion that the minimum charge rather than the estimated revenue should be the basis for computing income on any extension. In general it appeared from the remarks that the central-station companies of Wisconsin are planning to go ahead with extensions.

A representative of the Public Utilities Commission, speaking in the discussion, expressed the belief that public utility commissions are getting away from the policy of making general rules. It has been learned by experience that general rules will outlive the situations which they are created to cover, and that they thus outlive their usefulness and are very apt to create an embarrassing situation. This speaker also pointed out that a great many new-business men in central-station organizations are in the habit of referring to rules of the company or of the commission at times when a customer requests an extension which the new-business department does not feel justified in making on the basis of the revenue it will return. This not only antagonizes the customer, making him feel resentful against the company, but it also angers him so that he writes to the public utility commission to explain his grievance. This business of "passing the buck" to the public utility commission, the speaker thought, should be stopped.

INDUSTRIAL DEPARTMENT CREATES NEW BUSINESS

Outline of Accomplishments of Such a Department in the Communities Served by Wisconsin-Minnesota Company

A review of the accomplishments of the industrial department put into effect about three years ago by the Wisconsin-Minnesota Light & Power Company in its endeavor to encourage the securing of industries for the communities it serves was made by N. J. Whelan before the recent meeting of the Wisconsin Electrical Association.

This department was organized for the purpose of carrying out several clearly defined lines of work. First, a complete survey was made of the resources of the community served by the corporation. Data were collected as to the number of factories in each community, the number of people employed, the number of unemployed help available in contiguous localities, wage scales, price of factory sites, railroad facilities, housing accommodations, and the adaptability of communicating with various lines of manufacturing. Furthermore, this department was placed at the disposal of each community to help in the organization of commercial bodies, or where such organizations existed to help in industrial development.

While the company does not claim credit for all the developments made, still it believes that a considerable number of these industries that have been developed there would not have been in existence in that locality had it not been for the direct and indirect assistance given through the company's industrial department.

In placing industries a survey was made of the conditions existing in close proximity to the community involved as well as in the city. For instance, it was found that in some localities, on account of the existence of various kinds of timber, woodworking factories would be desirable. A special survey, therefore, was made of the woodworking field by a member of the board of directors of the company, and as a result there is one establishment turning out crates and boxes, employing at this time eighty-five people. In addition, a toy-manufacturing company has been organized and is doing a large volume of business. A phonograph factory is now in operation, and at no time since the beginning of this business has it been able to keep pace with the orders for its output.

Of value to the agricultural interests has been the erection of a canning factory, two salting plants and one sauerkraut factory. In a land survey undertaken by one of the communities attention was called to a large tract of clay land, and now there is in a preliminary stage of creation a plant for the manufacture of brick, sewer pipe, tiling and paving brick. A number of other factories have been placed, turning out iron and steel, rubber, automobile and other products. All told, the industries placed in these communities require the employment of 975 people, which is, of course, of direct and indirect benefit to both the communities and the utility company.

"Besides giving the company in a community a valuable knowledge of the community and industrial conditions," Mr. Whelan states, "and bringing community and company in close relationship, there is also the satisfaction on the part of the company of seeing industry develop, and it is gratifying to the officers of that organization to be able to say that the company was instrumental not alone in building up its own projects and organization but in helping to develop that entire portion of the state."

PARALLEL PLAN OF SELLING HELPS UTILITY AND DEALER

Better Distribution of Electrical Appliances Obtained Through the Combined Efforts of the Two Branches of the Industry

"It is necessary for the central station and for the dealer that they both sell electrical devices," said W. S. Heald, manager commercial service department of the Duluth (Minn.) Edison Electric Company, in a paper read recently before the Minnesota Electrical Association. The reasons back of Mr. Heald's statement and what he believes each of the two branches of the industry should do for the common good are as follows:

The central station receives a direct financial gain from every good electrical appliance a dealer sells, and the more successful dealers there are in business the easier it becomes for consumers to buy such devices. The dealer, on the other hand, benefits by the indorsement the central station gives to the use of energy-consuming devices, he profits by the utilities' advertising, by its general missionary work and by the large number of consumers who become familiar with the dealer's goods through visits to the central-station offices.

The central station is more interested in the number of devices sold than in who sells them. If the dealers will sell more, the central stations may sell less, but usually the central stations have to sell more because the dealer does not sell enough.

It is considered to be the function of the central station to encourage the use of electrical appliances by having a properly designed rate schedule for the purpose, by having attractive display rooms, efficient demonstrators and a repair shop where users may have their appliances repaired promptly and with little effort on their part. The central station should also conduct campaigns to educate the public in the advantageous use of the electrical devices which can be used in a home, and it should work with the architects to have a multiplicity of receptacles installed in all new homes. The lighting companies can help all dealers by maintaining list prices and can greatly assist the less experienced dealers in developing efficient merchandising methods.

The dealer, on the other hand, greatly benefits by the demand for his product created by the central station. The dealer should supplement the work of the utility by maintaining an attractive-looking store, he should only handle reliable merchandise and should be prepared to give his customers service after the sale has been made.

Both interests should combine to perfect ethical and more aggressive business methods, they should arrange to advertise the same things simultaneously in order to reap the advantage of cumulative advertising effect, and they should agree not to make conflicting statements about the operating costs and characteristics of any appliance.

The merchandising efforts of the central station and the dealer are complementary rather than competitive, and if this fact is remembered there will be better feeling between them and more merchandise sold.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Motors, Generators and Transformers

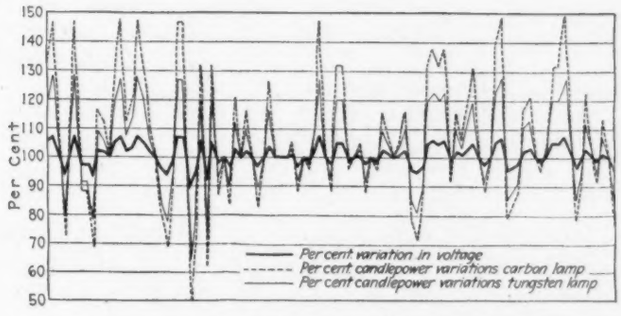
Winding Coils for Old Armatures.—Greater precautions are necessary in winding coils for repairing armatures than when the coils are to be installed in new armature cores. Additional insulation is necessary at corners and between leads where clearance with core is small and large radius bends give greater flexibility for rewinding. Several types of armature coils in different stages of manufacture are illustrated. It is also stated that coils should be tested under pressure while hot.—*Electric Railway Journal*, March 22, 1919.

High-Speed Rotors in Theory and Practice.—R. NEUMANN.—After referring, with references to the original sources, to the various authors who have dealt with the problem of rotating flywheels and their stresses and to the uncertainty involved in the calculations, the author advocates the large-scale factory testing of such parts as built-up rotors. A specially equipped testing pit, of "bomb-proof" construction, used by the A. E. G. for this purpose is then described.—*Science Abstracts, Section B*, Jan. 31, 1919. (Abstracted from *Elekt. Zeits.*, Aug. 8 and Aug. 15, 1918.)

Lamps and Lighting

Illumination of Hotel Rooms.—W. F. LITTLE and A. C. DICK.—A very comprehensive table of the illumination in various parts of hotels is given in this paper. One of the features brought out is that the guest rooms are not commonly illuminated sufficiently for writing and reading purposes.—*Transactions I. E. S.*, Feb. 10, 1919.

Urban Rapid Transit Car Lighting.—C. W. WILDER and A. E. ALLEN.—The study refers particularly to the underground rapid-transit systems of New York City. Investigations of illumination in cars carrying passengers indicate that, owing to fluctuations and contrasts, a minimum of 3 foot-candles is necessary for car lighting in order to avoid complaints from the traveling public. The fact that the starting load of a ten-car train is approximately 4000 amp. and that of a six-car train 2800 amp. results in a voltage at the operating car as low as 450. It is not felt, however, that the use of more copper in the feeders is justified in order to obtain better illumination alone. The curves shown herewith give an idea of the voltage fluctuation and consequent candlepower changes during a typical run in one of these systems. Conclusions from this study may be summed up as follows: (1) Under favorable conditions a satisfactory illumination may be obtained in a rapid transit car with about 1.4 watts per square foot of floor area; (2) the design of the car roof and the type of illumination may well be considered together, although it will not necessarily follow that the roof design can be subordinated entirely to the illumination; (3) about twenty units are necessary for proper distribution of light in cars within the dimensions of the two cars under discussion; (4) the location of the lighting units along the center line of the ceiling will not provide a satisfactory illumination under certain operating conditions that occur frequently.—*Transactions I. E. S.*, Feb. 10, 1919.



VOLTAGE AND CORRESPONDING CANDLEPOWER DURING A TYPICAL RUN

Generation, Transmission and Distribution

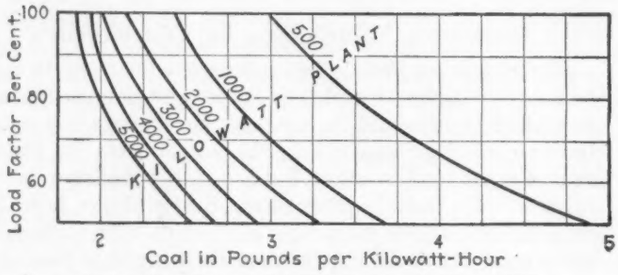
Saving Coal in Steam Power Plants.—Economy in any power-plant operation demands definite knowledge as to whether coal would be saved by purchasing power on the one hand or generating the power in a privately owned plant on the other hand. If the decision is in favor of the latter alternative, the problem how to save coal and obtain maximum production with minimum waste must be solved. A diagrammatic insert is attached to the paper which shows where and how much heat is lost in the plant. The main sections of the paper are headed: "Check Operation Closely," "Principal Losses in the Plant," "Power Plant Records," "Engine Room," and "Use of Exhaust Principal Factor."—*Reprint of Engineering Bulletin No. 2*, United States Fuel Administration (*Technical Paper 217*, Bureau of Mines).

Colloidal Fuel.—Under the direction of the Submarine Defense Association a considerable amount of work has been done during the war on the problem of combining coal with petroleum fuel oils. It is said that this problem has been very successfully attacked. It is now possible to combine in a stable liquid fuel about 45 per cent oil, 20 per cent tar and 35 per cent pulverized coal, thereby replacing over one-half of the oil, securing equal or greater heat values per barrel and saving considerable cost. Various combinations of these ingredients are given in the report, together with estimates of the possible savings through such combinations.—*Report of Submarine Defense Association*, March 1,1919.

Single-Wheel Compound Water Turbines and Multistage Centrifugal Pumps.—H. BAUDISCH.—Very narrow Francis turbines yield unsatisfactory efficiency. The lower limit of runner-wheel entrance breadth to runner-wheel entrance diameter is from one-fifteenth to one-twentieth, corresponding to a specific speed of about 60 r.p.m. There is a gap between the range of applicability of the Francis slow runner and that of

the free-jet high-speed runner, the highest specific speed of which with single nozzle is about 35 r.p.m. This gap is filled by the Pfarr compound turbine, in which water flows in series through several runners on one shaft. It is claimed that better results can be obtained at lower capital cost by allowing the water to flow twice or more through the same wheel. The guide and outlet chamber are divided into two equal parts. Half of the guide equipment is connected to the high-pressure pipe and half of the outlet chamber to the turbine suction pipe; the second half of the outlet chamber is connected to the second half of the guides. This single-wheel compound turbine has 100 per cent higher specific water volume than the Pfarr turbine and the same specific speed. It can be built as an axial or radial turbine or as a combination type; it can also be built as a spiral turbine with the spiral for each stage over one-half of the runner wheel. The use of a double-sided outlet on the runner wheel overcomes the axial thrust of the axial radial turbine.—*Science Abstracts, Section B*, Jan. 31, 1919. (Abstracted from *Zeits. Ges. Turbinenwesen*, 1 and 2, 1918.)

Rate of Coal Consumption in Various Electric Generating Stations and Industrial Establishments in Canada and the United States.—This material is worked up from data on electric power stations which use coal for fuel and use it entirely for generating steam. Tables



RATE OF COAL CONSUMPTION IN MANY PLANTS

are produced which give coal consumption in central stations ranging from 1000 kw. to 50,000 kw. The accompanying curve gives rate of coal consumption per kilowatt-hour for various sizes of plants.—Report of Hydro-Electric Power Commission of Ontario, Feb. 15, 1918.

COAL CONSUMPTION OF CENTRAL STATIONS

Station Capacity, Kw.	Maximum Load, Kw.	Kw.-hr. Generated	Kw.-yr. Generated	Per Cent. Load Factor	Lb. per Kw.-hr.	Tons per Kw.-yr.	Coal B.t.u. per Kw.-hr.	Coal B.t.u. per Lb.	Consumption, Tons per Year	Kw.-hr. per 100,000 B.t.u.	Efficiency, Per Cent.
650	425	1,123,820	128	29.3	7.65	34.60	95,600	12,500	3,930	1.04	3.5
2,980	1,570	4,703,600	538	34.2	4.30	19.00	55,500	12,900	9,230	1.80	6.2
7,230	3,820	10,422,000	1,190	31.7	4.07	17.80	48,500	11,900	20,200	2.06	7.0
24,600	10,760	33,500,000	3,820	36.0	2.90	12.75	39,600	13,600	48,030	2.50	8.6
96,000	62,060	200,679,750	23,650	36.9	2.00	8.80	28,000	14,000	201,420	3.57	12..1
149,000	92,080	360,218,000	41,000	44.7	1.92	8.40	25,900	13,500	345,580	3.86	13.1

Installations, Systems and Appliances

Electric Drive for Machine Tools.—A. SOULIER.—A well-illustrated article dealing particularly with the substitution of automatic for manual control in motor-starting apparatus. Starters actuated by push buttons and by means of contactors are described, as is the equipment of an electrically operated machine tool, and the method of installing motors upon machine tools comes in for examination.—*Revue Générale de l'Electricité*, March 8, 1919.

Electrophysics and Magnetism

Thermal Expansion of Molybdenum. — LLOYD W. SCHAD and PETER HIDNERT.—From a preliminary determination of the thermal expansion of molybdenum it is suggested that the most accurate equation between —142 and —19 deg. C. is: $L_t = L_o(1 + 5.15t \times 10^{-6} + 0.00570t^2 \times 10^{-6})$.—*Scientific Paper No. 332*, Bureau of Standards, Jan. 29, 1919.

Electrochemistry and Batteries

International Competition in the Products of the Electric Oven.—An editorial in the *Journal du Four Electrique* of Paris, dealing with the effect on the electrochemical and electrometallurgical industry of the change from war to peace, figures things out in this rather interesting way: "It seems indeed that from the point of view of international competition the most favored countries for production should be, first, those like France and Switzerland where the electrochemical and electrometallurgical factories work with electrical energy which belongs to them, because it is evident that they are able to count it at the minimum in their price of manufacture and to dispose of it at a profit to other industries if this be necessary. Next come the Scandinavian countries, where the power houses make long-term contracts for energy, the financial dependence of the system being compensated for by the relatively low price of electricity and the permanance of the supply, periodic service being the exception in that country. Finally, in the last category, must be placed countries like England, in which the energy is derived from the consumption of coal—that is to say, costs much more than hydroelectric energy—or those like the United States, where the cost of producing energy is much higher than in Europe, even for important and long-term contracts."

Metallic Carbides, Borides and Silicides. — JEAN ESCARD.—From the point of view of their manufacture these products belong to the domain of electrothermics. As regards their employment they are characterized by diverse qualities, such as their hardness, their metallurgical nature, the substances which on contact with certain bodies they form, etc. They tend to become more and more industrial products. The article here noted reviews them at length from this point of view.—*Revue Générale de l'Electricité*, March 1, 1919.

Units, Measurements and Instruments

Calibration of Base-Metal Thermocouples.—C. S. CROUSE.—The author takes up the subject of keeping base-metal thermocouples and pyrometers in a condition for accurate temperature control and gives a description of the equipment required. It has been found that the proper adjustment of such apparatus has resulted in marked improvements in the treatment of steel. It is

suggested that other industries interested in temperature control should find the material in this paper useful.—*Engineering and Mining Journal*, March 8, 1919.

Measurement of Water Flow by Orifice Buckets.—M. L. ENGER.—The orifice bucket is designed to meet rather special conditions and is peculiarly adapted for the measurement of water where a device which is portable, simple in construction and low in cost is essential. It is particularly suitable for the measurement of water when the water is discharged with considerable momentum from the end of a vertical pipe. The measuring capacity, moreover, covers a considerable range. The design of such a bucket for the measurement of water discharged from deep-well pumps is given in the bulletin with calibration curves which indicate that the apparatus is accurate within 5 per cent when properly applied.—*University of Illinois Bulletin No. 105*, May 13, 1918.

Instrument for Recording Sea-Water Salinity.—A. L. THURAS.—A new method of obtaining a continuous record of the surface salinity of ocean water by the measurement of electrical conductivity is described.—*Journal Washington Academy of Sciences*, Dec. 19, 1918.

Telegraphy, Telephony and Signals

Electrical Oscillations in Antennas and Inductance Coils.—JOHN M. MILLER.—The theory of circuits having uniformly distributed electrical characteristics, such as cables, telephone lines and transmission lines, has been applied to antennas. It is said that the results of this theory do not seem to have been clearly brought out, and it is hoped that in this paper some misunderstandings may be cleared up. No attempt has been made to show how accurately the theory applies to actual antennas. The transmission-line theory can also be applied to the treatment of the effects of distributed capacity in inductance coils.—*Scientific Paper No. 326*, Bureau of Standards, Oct. 23, 1918.

Safety and Fire Protection Engineering.—The report deals with the possibility of training disabled soldiers for service in safety and fire protection engineering.—*Report Federal Board of Vocational Education*, January, 1919.

Ground Telegraphy in the World War.—LIEUT. WILLIS L. WINTER.—The development of ground telegraphy in the war zone is described in this article, with the suggestion that this system of communication may be of interest as applied to civil life.—*Journal of Electricity*, March 1, 1919.

Unification of Telephone Systems.—D. E. WISEMAN.—The unification of the manual and automatic telephone systems of Los Angeles has been accomplished. The two systems had been operating side by side for over sixteen years, and the automatic system was the largest of its type in the country. For this reason the successful unification of these systems is of considerable interest.—*Journal of Electricity*, March 1, 1919.

Miscellaneous

Bureau of Mines' New Laboratories.—In this article a complete description of the new laboratories of the Bureau of Mines in Pittsburgh is given. A complete outline of the work proposed by the Fuel Section is also given.—*Power*, March 18, 1919.

Difficulties in Electric House Heating.—JOSEPH F. MERRILL.—Figures given by the author indicate that electric house heating is not a practicable load for the average power company at the present time nor is it likely to become so without radical advances in the economical generation of electricity.—*Journal of Electricity*, March 1, 1919.

Filing System for Central-Station Use.—G. C. HOGAN.—After much experimentation the Dewey decimal system was decided on by the Southern Sierras Power Company as the only adequate basis for a filing system. The actual system as adopted by this company is given as an example of how the general system may be fitted into the needs of such an organization.—*Journal of Electricity*, March 1, 1919.

Conservation of Meter Department.—J. T. KERMODE.—The writer outlines the experience of one company during the war, with particular reference to the operation of the meter department with what might have been considered an insufficient force. He says that certain of the men were selected as the most competent and these were assigned to positions of responsibility. In some instances they worked longer hours than normal, but the company was able to pay the men accordingly by the reduction of expenses in other ways. All clerical work and work of a mechanical nature was performed by women or younger men so that the expenses for this class of work could be reduced sufficiently to pay the good men better wages. With regard to the meter readers the company attempted to make use of a bonus system, depending upon the number of meters read, but considerable difficulty was encountered in that the meter reader would fail to visit the customer's premises and would put down fictitious readings which sometimes got the company into difficulties. Women have been used in the work of reading meters, and the company has applied the same scale of wages to them as to men provided they were able to read as many meters as the men formerly had been able to read.—*Ohio Electric Light Association Monthly*, February, 1919.

Future of the Electrical Industry in Rumania.—A communication from the Rumanian Minister of Public Instruction on the efforts making to substitute French influence for the former German control of the Rumanian electrical industry. The Minister sees a bright future for his country, which has great undeveloped natural resources and also abundant water power, permitting their economical development. With trifling exceptions the entire industry was before the war divided between the three great German companies, which, in adition to their exploitation of Rumanian resources, exported from Germany to Rumania about $6,000,000 worth of electrical products every year.—*Revue Générale de l'Electricité*, March 8, 1919.

Conversion of Complex Quantities.—W. H. GRINSTED.—The writer points out that in dealing with impedances the complex form is particularly useful in connection with addition and subtraction, but that the exponential form is preferable for multiplication and division. He describes a slide rule which may be used for the ready conversion of complex quantities into those of the exponential form and vica versa.—London *Electrician*, Feb. 14, 1919.

Functions of the Engineer.—W. A. J. O'MEARA.—The author analyzes the education and training of the engineer to show just how much his success in various positions depends upon the development of the different faculties. These faculties are divided into financial, commercial, technical, custodianship, bookkeeping and administrative. In particular the requirements for the various executive positions in a street railway undertaking are analyzed.—London *Electrical Review*, Feb. 21, 1919.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

MEETING OF THE AMERICAN ELECTROCHEMICAL SOCIETY

Report Opposing Government Operation of Hydroelectric Systems Is Adopted—Power Survey Is Favored—W. D. Bancroft President

The thirty-fifth general meeting of the American Electrochemical Society convened at the Chemists' Club, New York City, April 3, 4 and 5.

At the annual business meeting the committee on public relations presented a resolution placing the society on record as opposed to government ownership and operation of hydroelectric systems. The report was adopted by a large majority. Its text follows:

It is understood that this report does not consider the question of the government ownership of sources of hydroelectric energy nor of government control and regulation of hydroelectric systems, but simply operation by the government of hydroelectric systems in comparison with operation thereof by private companies. As regards this aspect of government ownership, it is the opinion of your committee:

(1) That anything which affects, either for good or evil, electrochemical industries will affect in a corresponding way the people as a whole.

(2) That in general all activities of an industrial nature undertaken by governments, at least in democratic countries, are inefficient, uneconomical and open to numerous inherent objections.

(3) That all activities of an industrial nature which can be carried on by private enterprise should not be undertaken by governments.

(4) That the inherent defects of governmental activities in industrial enterprises will be found in government ownership of hydroelectrical systems and will affect the electrochemical industries dependent on such systems adversely.

(5) That the Ontario Hydro-Electric Commission, the only available example of a government-owned hydroelectric system, illustrates the dangers and defects of governmental activities of this sort.

That the American Electrochemical Society, being interested in and representing the electrochemical industries of the United States, should strongly oppose all attempts at governmental operation of hydroelectric systems.

It is needless to present any evidence to the members of the American Electrochemical Society that the electrochemical industries are of vast importance to the whole nation and to every individual composing it.

Even a superficial examination of numerous governmental activities shows that those which can only be undertaken by the government leave much to be desired in their results, and that when these are of an industrial nature they are invariably inefficient, uneconomical and subject to numerous glaring defects which are obviously inherent in governmental work of this kind in a democracy, when the present state of human character is considered. Under an autocratic government certain causes of the defects of such governmental activities do not exist; but, as recent experience has shown, even when the existence of a democratic nation is threatened by external aggression and a temporary reversion to autocratic government becomes necessary, governmental industrial enterprise is far inferior to private undertakings of this nature.

It is the belief of all American citizens that governments are instituted among men to secure certain unalienable rights, among which not the least is individual liberty, and that the reason why their country has prospered so wonderfully is because those intrusted with its administration have not only confined themselves within their constitutional spheres but have refrained from encroaching on and consequently diminishing the fields of activity of its citizens. Most of our citizens who have given the matter careful thought also believe that governmental encroachment in such fields will greatly overbalance in permanent evil any partial or transient benefit which it may yield.

There is no evidence that governmental ownership of hydroelectric systems will be any freer from defects than other kinds of governmental industrial enterprise, but quite the contrary.

Your committee believes that the American Electrochemical Society should have an opportunity to go on record as opposed to government ownership and operation of hydroelectric systems and that this record should be given the widest publicity.

The society also approved the proposal that a water-power survey of the country should be made by the United States Geological Survey and that a special investigation of the power supply of all kinds in the industrial region of the North Atlantic seaboard should be undertaken. The resolution urged upon Congress the appropriation of $50,000 for a general survey of the country and $200,000 for the North Atlantic seaboard.

Election of Officers

Officers for the ensuing year were elected as follows: President, W. D. Bancroft; vice-presidents, J. V. N. Dorr, W. R. Whitney and Carl Hering; managers, H. C. Parmelee, R. E. Zimmerman and E. Blough; treasurer, P. G. Salom; secretary, J. W. Richards.

The society delegated F. A. Lidbury to attend the meeting of the national service committee of the Engineering Council in Chicago, April 23-25, with instructions to support the establishment of a department of public works.

The technical feature of the meeting was a symposium on released information relating to the war work done by electrochemists. Colonel Walker gave an illustrated address on the Edgewood Arsenal. Several papers were presented on the subject of smoke used as screens by the navy, the materials being silicon-tetrachloride and titanium. There were some important papers on electro-deposition of gold, silver, nickel and lead. G. B. Klugh of Anniston, Ala., described the production of silico-manganese in the electric furnace, using silica rock, manganese ore, limestone and bituminous coal as raw materials. The furnaces were three-phase with three electrodes in line. The current was transformed down to 65-100 volts. The power consumption was 9000 kw.-hr. per ton of metal. Another electric furnace paper was presented by T. F. Baily, who described heat treatment of anchor chain, draw-bar knuckles and airplane parts.

The social features of the meeting were a smoker and an excursion to some industrial plants on Long Island.

MAINE WATER POWER COMMISSION IS FORMED

New Body Authorized by Legislature Through Appropriation of $40,000 Will Investigate Water-Power Resources and Recommend Policies

A special commission to investigate further the water-power resources of the state and to recommend future policies of development was created by the Maine Legislature during the closing days of the recent session. The commission is to take over the water-resources data of the Public Utilities Commission, and an appropriation of $40,000 has been authorized to cover the cost of the investigation. A report is to be made to the Legislature of 1921 through the Governor and Council, and among the subjects to be considered are the flow of rivers and their drainage areas, storage facilities existing and potential, state rights in developed and undeveloped water power, transmission of energy outside the state, and the private versus State development and ownership of water powers.

The commission, known as the Maine Water Power Commission, receives authority to employ engineers and other assistants and is to be assigned quarters in the State Capitol at Augusta. It is to be composed of ten members, including three members of the Seventy-ninth Legislature and one delegate each from the Maine State Board of Trade, Maine State Grange, Maine State Federation of Labor and Savings Bank Association of Maine. Commissioners not members of the State Legislature are each to receive $5 per day while engaged in commission work, and all commissioners are to be allowed expenses connected with these duties.

The agitation on behalf of public ownership and development of water powers which was such a prominent feature of the previous session's work failed this year to gain headway and appears to have lost ground as well. An absolutely open and above-board newspaper campaign against public ownership was run last fall on a coöperative basis by about a dozen leading public utility and industrial companies utilizing water-power developments.

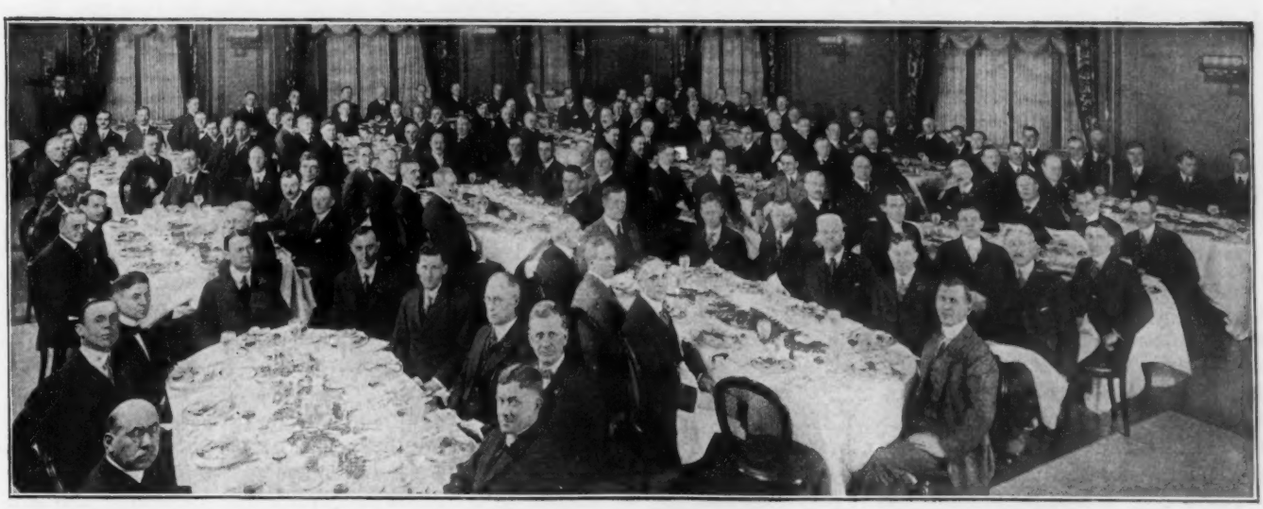
This campaign, which was noted in the ELECTRICAL WORLD as an unusual example of effective publicity, culminated in two pamphlets which were sent to every member of the 1919 Legislature and to others before the session opened. One pamphlet recapitulated the points against public ownership which were emphasized in the signed press advertisements, and the other one brought out various unfavorable aspects of the public ownership and development of water power by the Hydroelectric Commission of Ontario as contrasted with the claims often advanced in support of the latter organization's work and policy.

In his message to the Legislature Governor Milliken pointed out that "the financial obstacles in the way of State ownership make such a course for the present absolutely out of the question, whatever merit it might otherwise have," and commended the admirable and exhaustive report of the Public Utilities Commission on water-power resources in Maine as the basis of any constructive program for the development of these resources that may be entered upon.

Western Society of Engineers Discusses Legislation

On March 31 the Western Society of Engineers in conjunction with a large number of other engineering societies held a public affairs session to discuss important legislation pending before the Illinois State Legislature and the City Council in Chicago. The discussion was led by James J. Barbour, State Senator; Bert H. Peck, electrical engineer Public Utilities Commission of Illinois, and Douglas Southerland, secretary of the Civic Federation of Chicago. Mr. Peck outlined the organization and the accomplishments of the Illinois commission since it was formed in 1914.

Banquet Given to Colonel Junkersfeld by His Chicago Associates



One hundred and thirty friends of Peter Junkersfeld, formerly of the Commonwealth Edison Company, gathered at a banquet in his honor at the Chicago Athletic Club, Chicago, on April 5. L. A. Ferguson, vice-president of the Commonwealth Edison Company, acted as toastmaster. The speakers—Britton I. Budd, Chicago Elevated Railways, W. L. Abbott and R. F. Schuchardt of the Commonwealth Edison Company—expressed the sentiments of the assemblage in wishing Colonel Junkersfeld farewell and good luck in his new work with Stone & Webster.

THE VICTORY LIBERTY LOAN

BY JOHN PRICE JONES

Assistant Director of Publicity Liberty Loan Committee, New York

NO ONE whose life is spent over matters electrical need be told of the manifold uses of electrical apparatus in the war. The electrical engineers have done a work of which the country may well be proud. And now, with all other Americans, they are called on for one last "bit" in the war — the financial part. The Victory Liberty Loan — the last of the popular loans — will be put out in April.

In the first place, much of the money is to be spent in bringing back the troops from overseas, and that will include the electrical engineers and electrical men of every branch of the trade who are now in the A. E. F.

In the second place, there is a special provision in the Victory Liberty Loan bill, as passed by Congress and signed by the President, which is (or should be) of great importance to electrical men. This is the special provision for the extension of credits for the promotion of American foreign trade.

Germany previous to 1914 had built up an enormous foreign trade, no small portion of which was in electrical apparatus, machinery and novelties. Germany will, of course, recover some foreign markets. Our allies will seek to capture some, and some should open readily to us.

But attempts to gain a footing in foreign fields frequently have failed because the home firm could not obtain extended banking credits to carry it through the slow process of getting established in the new market. Foreign consignees — especially in South America — have always demanded long credits from the consigning firm, longer credits than American firms could usually obtain in this country.

The Victory Loan act will permit American exporters—and behind them American manufacturers—to develop foreign business with a feeling of security. And this includes in no small measure manufacturers in the electrical field.

Are not these cogent reasons for electrical men to get behind the Victory Liberty Loan? We know that they are, and we know that the readers of the ELECTRICAL WORLD will do a mighty bit in putting the loan across!

INDUSTRIAL LIGHTING RULES ARE FORMULATED IN OHIO

Code Consists of Four Rules and a Lengthy Appendix —Latter Made Necessary Because of Lack of General Knowledge of Illumination

Establishing grades or classes of industries and trades each calling for a different intensity of illumination and requiring that objectionable glare shall be eliminated from either natural or artificial light are the important features of the proposed Ohio Industrial Lighting Code as explained by Prof. F. C. Caldwell, Ohio State University, before a recent meeting of the new-business committee of the Ohio Electric Light Association. The code proper consists of only four rulings, but a lengthy appendix fills the purpose of giving educational and advisory methods for carrying out the code rules. The first five sections of the appendix are strictly informational, defining the most important terms used in connection with the work on lighting. The minimum and the preferred values of intensity for given working conditions are included for the convenience of the reader. A section on the character of illumination undertakes to give such information with regard to glare as will permit the successful enforcement of the rule regarding that objectionable characteristic of improper lighting. The last twelve sections of the appendix are all informational in character and take up briefly such subjects as the value of good illumination, accident prevention, location of lighting units, lamp accessories, maintenance, cleaning and inspection, etc.

EXHIBIT OF THE "NEW SPIRIT OF LIGHTING"

Special Lighting Exhibit by N. E. L. A. Lamp Committee and Lighting Sales Bureau to Be Feature at Atlantic City Convention

An interesting feature is being planned for the coming convention of the National Electric Light Association at Atlantic City for the purpose of expressing to the industry what has been called "the new spirit of lighting." Through the coöperation of the N. E. L. A. lamp committee and the lighting sales bureau of the Commercial Section, the more interesting aspects of modern lighting are to be presented in the form of a special exhibit to occupy a conspicuous position in the exhibition hall.

This special lighting exhibit will be composed of ten separate booths or sections, the outstanding features of which will be elaborate presentations of industrial, store, window and home lighting. The industrial lighting exhibit, for instance, will be a typical modern machine shop with machinery representing several classes of industry installed and running. Illumination will be provided by three systems of lighting. One will show the too prevalent scale of poor lighting, another a good standard of illumination, and a third will present what is considered the best productive intensity. These several systems of illumination will be operated from a control pedestal and will be demonstrated by the man in charge to all interested visitors. At other times this control pedestal will be automatically operated by a flasher as a constant demonstration of the effectiveness and efficiency of good lighting in a factory.

For the purpose of demonstrating the best modern standards of show-window illumination a life-size show window will be installed in which there will be a practical display of merchandise. It is expected that this display will be changed daily during the convention under the guidance of some prominent Atlantic City or Philadelphia department store. This show window will be equipped with about fifteen different systems of show-window lighting, demonstrating different intensities of illumination from different directions. These systems also are to be operated from a central control table and automatically demonstrated at periods when they are not specially displayed.

There will be another space devoted to home lighting, which will comprise a number of typical rooms characteristic of a modern moderate-priced dwelling and will represent in large measure the home-lighting problem of the day. These rooms will be illuminated by a flexible system of lighting which will enable the operator to demonstrate the advantages of different types of fixtures and different ideas in the arrangement and

location of lighting outlets. There will be a variety of portable lamps in use, not as an exhibition of the lamps themselves but merely as incidental to the illumination.

Then there will be other sections given up to the display of indoor lighting equipment and outdoor lighting equipment. There will be a room devoted to the newer applications of lighting, such as the moving-picture field and the use of projector lighting. There will be a room given up to central-station lamp practice, illustrating the report of the lamp committee on the standardization of voltage, recent experience in the merchandising of lamps and other data showing what central stations are doing in the lighting field. In another section will be gathered together the educational literature available on lighting subjects. Here will be files giving a key to the different items of equipment featured in the different parts of the exhibition, standard and special equipment now in use in varying phases of lighting prospects and other general information.

The foyer of the lighting exhibit will be attractively furnished as a rest room and illuminated entirely by portable lamps. At the end of the foyer will be a moving-picture screen where a large number of exceedingly interesting films on both lighting and other electrical subjects will be shown.

Undoubtedly this year will see great acceleration in the popular interest in lighting subjects and in the general activity of the central-station industry in the development of this field. Much has been learned through the war period of the economic influence and value of specific types of lighting under definite conditions, and the effort of the industry will be to apply this knowledge more broadly. It is this new spirit of lighting which this special lighting exhibit will define and present to the convention, and it is believed that it will be helpful and stimulative. For the benefit of men who will be unable to attend this convention this lighting exhibit will be carefully photographed and a report will be published for general distribution.

BENEFITED BY LESSONS FROM WAR CONDITIONS

W. S. Barstow & Company Point Out Favorable Position of Power and Lighting Companies, Instantly Adaptable to Peace Conditions

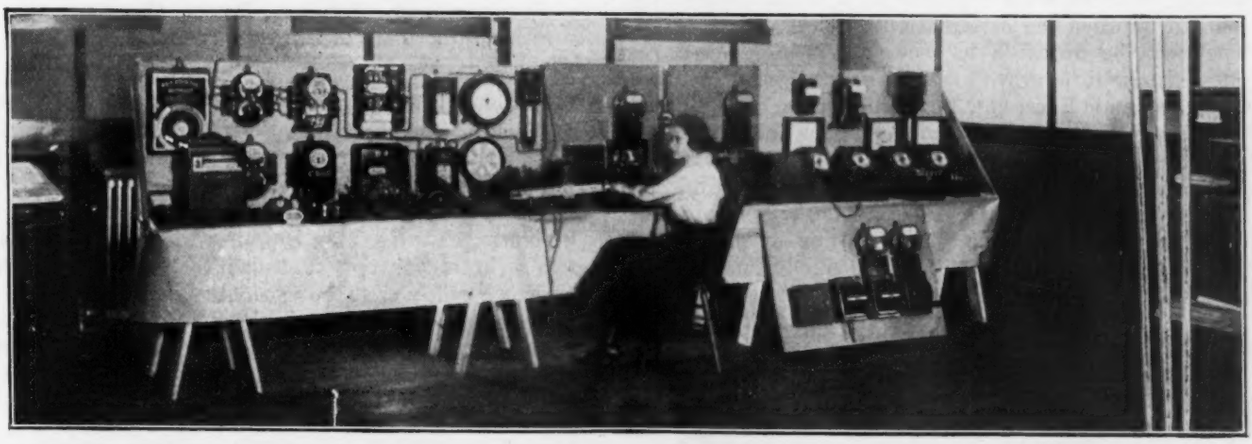
A review of the public utility situation by W. S. Barstow & Company, New York, says in part:

The law of supply and demand set aside during the war by the government must gradually begin to function before any permanent recovery can take place. Many laws heretofore thought constructive had actually proved in practice to be destructive, and this legal condition must be corrected without delay. In many cases it remained for the government itself to bring forcibly to light the glaring defects of past legal policies. Readjustment of these laws will require time and careful thought, but the quicker corrections are made the sooner industrial activity will begin.

Many industries have been created for war needs only, and the dismantling of these and the building up of new enterprises to take their place will require financial aid. Whether such aid will be immediately forthcoming will depend much upon the government's attitude in demobilizing war industries and establishing by law a constructive policy for steam railroads, other public utilities and industrial enterprises.

While many manufacturing establishments must either discard or change their machinery and class of labor in the shift from war to peace conditions, public utilities occupy an especially favorable position in this respect. The power and lighting companies during the past two years have confined their services to war requirements. They have installed machinery and transmission systems to meet the war-time conditions, but the same machinery and transmission systems would have been installed during peace-time conditions, so that they are now ready, with no involving financial adjustments, not even in the class of labor or reconstruction, to adapt themselves instantly to peace conditions. The demand during the last two years on the part of the government for services rendered by public utility companies has taken the place of expensive selling campaigns, as the use of electric power has been forced to the front by necessity of manufacturers who required instant relief and adopted this class of service without question.

Electrical Interest Stimulated by Worcester Company Section, N. E. L. A.



Through the Worcester (Mass.) Electric Light Company section of the N. E. L. A. increasing interest in electrical affairs is being locally stimulated, and contractor-dealers as well as central-station employees are coöperating to secure mutual benefit. The section is resuming activities interrupted by the war, and all the women employees of the company have become associate members. The first open meeting of the year was recently held and addressed by G. M. Hardy, superintendent of the service department, the subject being "Meters." Various types and makes were shown as illustrated herewith, including speed counters, watt-hour, demand, recording, voltage and curve-drawing outfits, and a demonstration was given by Miss Cook of the company laboratory of the testing of a Sangamo 5-amp. single-phase wattmeter. H. D. Stokes is chairman of the company section and meetings are held every month.

CONTRACTORS' BUREAU OF EDUCATION AND RESEARCH

Announcement by the National Association of Its New Organization to Lead Contractor-Dealers to Develop Their Business and Improve Their Methods

A Bureau of Education and Research is to be established by the National Association of Electrical Contractors and Dealers, New York. The bureau is designed to collect and compile data and statistics in order to show what is needed to increase the retail distribution of electrical merchandise and place it on a more efficient basis and to place this information before the industry. Through this means it is proposed to enable those in the industry through local coöperation to bring about the desired results in modern electrical retail shops.

The committee in charge is composed of W. Creighton Peet, Peet & Powers, New York, national chairman; M. Edwin Arnold, M. E. Arnold & Company, Philadelphia, chairman national membership committee, and A. Penn Denton, Economy Electric Construction Company, Kansas City, Mo.

The work of the bureau is to be carried out by obtaining in the various localities throughout the country coöperation between the manufacturers, jobbers, central stations and retailers, so that all branches will be working together to increase the retail distribution of electrical material.

Preparatory work will be conducted through suitable printed matter laying out the aims and objects of the movement and what is necessary to accomplish the results. This is to be followed by personal field work. The foregoing will be supplemented by lectures on management, selling, accounting, estimating and installing. The lectures will be prepared by the bureau in such form that they can be furnished to any locality, but the entire arrangement for and delivery of the lectures will be under local supervision and at properly advertised open meetings. Where circumstances do not warrant the delivery of lectures the subject matter will be furnished in printed form.

Field men will call on the various interests in the industry in the different localities for the purpose of getting them to work together on a broad coöperative plan to improve the distribution of electrical material. They will be prepared to show the retailer when requested how to improve his store and business methods along economic lines, how to install and carry on proper cost accounting and bookkeeping systems and to take up any other subject on which assistance is requested.

While it is felt to be necessary that this work be carried on by the retailers' organization, it is recognized that the retailers are not in a position at present to finance this educational work unaided. Financial support is asked from manufacturers, jobbers, central stations and others interested in obtaining the results outlined.

As subscribers will be directly benefited by the increased sale of resale material and energy-consuming devices which will be produced by the work of the bureau, they are asked to subscribe on a yearly basis a sum approximately equal to 25 cents on each thousand dollars' worth of sales of such resale material, or in the case of the central station, the sale of energy, with a minimum subscription of $50 per year and a maximum of $10,000 per year, excluding sales of material for export and any sales to governmental or state departments. Individual subscriptions will not be made public.

The money contributed will be expended by and through the National Association of Electrical Contractors and Dealers with the understanding that part will be for general work covering the entire country and part will be on special work in the different localities in proportion to their numerical membership in the national association. The result will be that each locality will receive benefits in proportion to the activity and interest shown in such locality.

Subscribers will be accorded privileges of associate members of the National Association of Electrical Contractors and Dealers. A list of subscribers will be distributed.

There will be an advisory committee of representatives from each branch of the industry—manufacturers, central stations, jobbers, engineers and electrical press—to be selected through consultation with subscribers from each branch. Matters of policy will be passed on by this committee before being finally acted on by the managing committee.

It is expected that the work will result in stabilizing the contracting business by inducing contractors to operate retail stores requiring a fixed permanent investment in their business. Increase in number of retail stores, education of the retailer to handle appliances properly and the increase of suitable wiring installations for the use of appliances must of necessity, it is pointed out, increase sales of materials, and through the sale of energy-consuming devices increase largely the use of electricity.

It is especially noted that the funds for the bureau are not to be applied to regular work of the national association, which in 1918 cost approximately $35,000 and is on a self-sustaining basis. The benefit to the national association arises from improvement in general business conditions of the electrical contractor-dealer and the increase in membership, which will tend of itself to improve, increase and stabilize distribution.

MEMBERS FOR ELECTRIC FURNACE ASSOCIATION

Campaign to Be Extended to Cover Manufacturers of Furnaces and Supplies, Power Companies, Manufacturers of Furnace Products, Etc.

A meeting of the newly formed Electric Furnace Association was held on April 3 at the Chemists' Club, New York, at the call of the president, Acheson Smith, and a large number were present. Reports of the various standing committees were made, and a tentative draft of the constitution and by-laws was submitted.

Resolutions were passed adopting the constitution as drawn for a temporary period until the new membership committee, which is to be created at once, can secure a representative list of members from the various industries interested in the work of the association. After such membership is formed the draft of the constitution will again be considered and accepted in final form.

An aggressive campaign for membership will be undertaken at once, and all manufacturers of electric furnaces, electric furnace supplies, power companies, manufacturers of electric steel, electric brass and other electric furnace products, designers, inventors of furnaces, etc., will be invited to become members.

An early meeting of the directors of the association will be held to go into further details.

ADVOCATE REFORMS IN PATENT OFFICE SYSTEM

Employees Organize Patent Office Society for Purpose of Advocating Changes in Administrative Branches of the Department

Employees of the United States Patent Office, Washington, have organized, under the name of the Patent Office Society, for the purpose of advocating certain reforms in the administrative branches of the department which, it is claimed, will bring about a higher efficiency in the system. Committees on legislation and publicity have been appointed with a view to educating the public to the necessity for an immediate improvement of the present Patent Office system and to push Congressional enactment to broaden the scope of the department.

The plan includes the separation of the Patent Office from the Department of the Interior and provides for an executive officer who shall be an industrial and efficiency expert, the position eventually to be that of a Cabinet officer when the department shall have assumed the proportions to warrant such a distinction.

The main contention is that the Patent Office is separate and distinct from the Department of the Interior in its administration and functions and that no progress can be made until a separation is effected. A lack of close affiliation appears, it is claimed, from which the Patent Office must necessarily suffer in matters of proper appropriation for maintenance and expansion and for many other reasons.

The views of the society have been set forth by James H. Lightfoot, the examiner of the Patent Office, in papers presented by him before the examining corps of the department. Mr. Lightfoot makes the following assertions regarding the inefficiency of the present system:

1. That all patents granted are still merely prima facie evidence of the rights of inventors to their invention, whereas the grant itself and the Constitution provide for the grant of unconditional, secure and exclusive rights.

2. That, although the statute (4886) requires as a condition precedent to the grant that the alleged invention sought to be patented must have been in fact invented, patents have been granted and are still granted for things not invented because of insufficient time and inadequate facilities for the proper consideration of this important question, and patents have been and are still refused because of the want of the proper system requiring the presentation of practical evidence indicating invention for the consideration of the examiner.

3. That, although the statute requires as a condition precedent to the grant that the alleged invention sought to be patented must be new, patents have been granted and are still granted for things not new.

4. That, although the statute requires as a condition precedent to the grant that the subject matter sought to be patented must be useful and, under Statute 4893, that it must be "sufficiently useful and important," patents are still granted for theoretical and sometimes practically useless alleged inventions, which have later constituted bars to the grant of patents to inventors of real inventions which would have practically promoted the industrial arts.

5. That although the statute (4886) requires as conditions precedent to the grant (a) that the alleged invention must not have been known or used by others in this country before the applicant's invention or discovery thereof; (b) that the alleged invention must not have been in public use or on sale in this country for more than two years prior to the application, (c) and that the alleged invention must not have become abandoned, patents generally have been granted without any investigation of these important questions affecting validity.

6. That although the revised statute (4903) requires that helpful information be furnished to applicants to aid them in obtaining proper protection, patents are still granted the claims of which are so limited in scope as to be valueless to the inventor for want of a uniform standardized system of examining the applications.

7. Although the provisions of the revised statute (4904) provide for notice in all cases of interfering applications or interfering applications and patents, patents are still granted which are rendered practically valueless and the industries based thereon practically ruined by the subsequent grant of interfering patents on copending applications of which the former patentees had no statutory notice during the copendency of such applications.

8. That patents are still litigated in courts which, with some few able exceptions, are not specially qualified promptly and properly to determine the technical questions arising under the patent laws.

Mr. Lightfoot recommends in the reorganization of the Patent Office Society the establishment of five bureaus, namely, Bureau of Information and Education, Bureau of Patents and Publications, Bureau of Utility, Bureau of Validity Examinations, and Bureau of Priority of Inventions. These recommendations have been approved by the Patent Office Society.

This greater and broader Department of Invention and Discovery may possibly also include a Bureau of Licenses and Sales, just as the Department of Agriculture has a Bureau of Markets.

The society is publishing a monthly journal in the interests of the principles advocated in the reorganization of the Patent Office.

The officers of the society are as follows: President, N. H. Coulston; vice-president, J. H. Lightfoot; secretary, Bert Russell; treasurer, W. F. Avery; executive committee, A. W. Cowles, E. S. Glascock, G. A. Lovett, C. H. Pierce, M. E. Porter, E. D. Sewall, W. L. Thurber and W. J. Wesseler.

The business manager of the journal is W. J. Wesseler.

SALE OF THE BRITISH WESTINGHOUSE HOLDINGS

Chairman Tripp, Returning from England, Announces Sale of Interests and New Commercial Alliance Looking to Development of Export Business

Gen. Guy E. Tripp, chairman of the board of the Westinghouse Electric & Manufacturing Company, returned to New York this week from a trip to England. He said that the British interests have practically been sold.

"Subject to the successful accomplishment of certain legal details in Europe, which, however, may be waived by the Westinghouse company if thought desirable," said General Tripp, "an agreement has been reached with certain important British interests under which the Westinghouse company sells for cash its British holdings and enters into a commercial alliance looking to the development of export business.

"The commercial plan will be instituted immediately upon the assumption that the whole deal will be consummated on one of the bases above indicated. No further details can be given out at this time."

General Tripp believes that foreign trade prospects depend on the successful outcome of the peace conference. Some method of international financing to provide for the obligations growing out of the war must be found, he declared, before normal commercial conditions can be expected.

Census Bureau Report of Electric Light and Power Stations—1917

	Missouri			Pennsylvania			Michigan		
	1917	1912	Per Cent of Increase * 1912 to 1917	1917	1912	Per Cent of Increase * 1912 to 1917	1917	1912	Per Cent of Increase * 1912 to 1917
Number of establishments	293	190	54.2	284	284	.....	241	235	2.6
Commercial	206	125	64.8	232	239	—2.9	132	127	3.9
Municipal	87	65	.....	52	45	.....	109	108	0.9
Income	†$14,434,506	†$9,746,600	48.1	‡$52,259,350	‡$24,387,863	114.3	¶$24,095,328	¶$11,518,256	109.2
Electric service	$13,974,980	$9,299,495	50.3	$49,677,404	$23,482,208	111.6	$23,560,198	$11,127,031	111.7
All other	$459,526	$447,105	2.8	$2,581,946	$905,655	185.1	$535,130	$391,225	36.8
Total expenses, including salaries and wages	$12,790,796	$7,484,853	70.9	$42,899,262	$18,174,684	136.0	$19,216,138	$9,784,138	96.4
Number of persons employed	3,766	2,434	54.7	10,735	7,300	47.0	4,738	3,876	22.2
Salaries and wages	$2,776,597	$1,883,844	47.4	$9,598,492	$5,098,265	88.3	$5,223,067	$2,843,371	83.7
Total horsepower	226,030	182,095	24.1	1,290,190	615,994	109.4	612,632	377,182	62.4
Steam engines:									
Number	309	301	2.6	529	615	—14.0	272	319	—14.7
Horsepower	199,950	177,721	12.5	1,194,086	465,968	136.9	411,603	250,477	64.3
Internal-combustion engines:									
Number	177	22	.....	85	84	.....	76	27	.....
Horsepower	7,415	2,472	200.0	19,496	17,733	9.9	3,014	1,626	85.4
Waterwheels:									
Number	12	5	.....	133	136	—2.2	312	245	27.3
Horsepower	18,665	1,902	881.3	166,608	132,293	25.9	198,015	125,079	58.3
Kilowatt capacity of dynamos	166,813	122,786	35.8	910,434	427,304	113.1	450,716	247,789	81.9
Output of stations, kilowatt-hours	266,431,159	232,828,763	14.4	3,049,493,792	989,665,167	208.1	1,504,239,843	525,615,508	186.2
Stationary motors served:									
Number	10,710	15,429	—30.6	64,227	29,119	120.6	37,799	18,400	105.4
Horsepower	174,861	116,971	49.5	1,139,935	333,414	241.9	348,811	174,009	100.4
Number of street lamps:									
Arc	4,410	6,687	—34.1	43,521	45,596	—4.6	18,102	16,220	11.6
Incandescent, etc	30,079	16,719	79.9	114,706	28,630	300.6	41,365	22,425	84.4

* A minus sign (—) denotes decrease; percentages omitted where base is less than 100.
† Exclusive of $1,665,408 in 1917 and $551,422 in 1912, reported by street and electric railway companies as income from sale of electric energy.
‡ Exclusive of $1,031,954 in 1917 and $708,458 in 1912, reported by street and electric railway companies as income from sale of electric energy.
¶ Exclusive of $326,581 in 1917 and $426,444 in 1912, reported by street and electric railway companies as income from sale of electric energy.

	South Dakota			North Dakota			Alabama		
	1917	1912	Per Cent of Increase * 1912 to 1917	1917	1912	Per Cent of Increase * 1912 to 1917	1917	1912	Per Cent of Increase * 1912 to 1917
Number of establishments	130	77	.....	127	42	.....	882	69	.....
Commercial	95	64	.....	101	33	.....	37	34	.....
Municipal	35	13	.....	26	9	.....	45	35	.....
Income	†$2,050,067	†$1,162,522	76.3	$2,003,826	$873,111	129.5	‡$3,152,709	‡$1,257,720	150.7
Electric service	$1,885,697	$1,095,922	72.1	$1,712,441	$835,504	105.0	$3,018,778	$1,234,540	144.5
All other	$164,370	$66,600	146.8	$291,385	$37,607	674.8	$133,931	$23,180	477.8
Total expenses, including salaries and wages	$1,733,635	$965,763	79.5	$1,647,691	$714,294	130.7	$2,895,713	$980,169	195.4
Number of persons employed	446	338	32.0	419	232	80.6	806	456	76.8
Salaries and wages	$408,670	$264,159	54.7	$343,741	$197,983	73.6	$602,050	$286,936	109.8
Total horsepower	32,176	27,748	16.0	29,079	16,169	79.8	182,793	34,473	430.2
Steam engines:									
Number	55	50	.....	117	74	.....	120	94	.....
Horsepower	15,800	16,003	—1.3	24,679	15,851	55.7	79,232	24,574	222.4
Internal-combustion engines:									
Number	178	86	.....	157	8	.....	8	2	.....
Horsepower	10,006	4,832	107.1	4,400	318	1,283.6	705	19	.....
Waterwheels:									
Number	11	15	.....	.....	.....	.....	18	15	.....
Horsepower	6,370	6,913	—7.9	.....	.....	.....	102,856	9,880	941.0
Kilowatt capacity of dynamos	24,248	20,032	21.0	20,041	10,824	85.2	128,509	24,477	425.0
Output of stations, kilowatt-hours	31,810,487	24,703,754	28.8	22,978,006	12,298,553	86.8	330,771,965	48,602,553	580.6
Stationary motors served:									
Number	3,143	1,394	125.5	2,281	1,145	99.2	1,583	1,065	48.6
Horsepower	19,673	13,619	44.4	11,102	6,128	81.2	17,363	11,148	55.7
Number of street lamps:									
Arc	386	904	—57.3	497	644	—22.8	1,702	2,314	—26.4
Incandescent, etc	7,558	4,382	72.5	11,028	5,074	117.3	7,212	2,805	157.1

* A minus sign (—) denotes decrease; percentages omitted where base is less than 100.
† Exclusive of $49 in 1917, reported by street and electric railway companies as income from sale of electric energy.
‡ Exclusive of $1,402,496 in 1917 and $1,017,134 in 1912, reported by street and electric railway companies as income from sale of electric energy.

	Ohio			Texas			Wisconsin		
	1917	1912	Per Cent of Increase * 1912 to 1917	1917	1912	Per Cent of Increase * 1912 to 1917	1917	1912	Per Cent of Increase * 1912 to 1917
Number of establishments	335	304	10.2	254	253	0.4	269	251	7.2
Commercial	186	186	.....	230	235	—2.1	171	173	—1.2
Municipal	149	118	26.3	24	18	.....	98	78	.....
Income	†$23,019,289	†$11,905,111	93.4	‡$10,232,709	‡$6,783,972	50.8	¶$11,923,367	¶$6,274,589	90.0
Electrical service	$22,149,767	$11,514,628	92.4	$10,000,025	$6,654,616	50.3	$11,594,068	$5,955,194	94.7
All other	$869,522	$390,483	122.7	$232,684	$129,356	79.9	$329,299	$319,395	3.1
Total expenses, including salaries and wages	$20,703,414	$8,722,293	137.4	$8,211,360	$4,924,093	66.8	$9,715,528	$5,321,258	82.6
Number of persons employed	4,713	3,131	50.5	2,531	2,021	25.2	2,719	1,921	41.5
Salaries and wages	$4,143,689	$2,264,892	83.0	$1,968,423	$1,348,966	45.9	$2,475,971	$1,227,013	101.8
Total horsepower	581,774	337,272	72.5	184,829	126,616	46.0	368,211	145,411	153.2
Steam engines:									
Number	425	506	—16.0	311	385	—19.2	262	272	—3.7
Horsepower	556,230	317,160	75.4	156,762	113,611	38.0	219,534	72,145	204.3
Internal-combustion engines:									
Number	117	93	.....	214	99	.....	92	46	.....
Horsepower	11,928	11,252	6.0	24,714	9,502	160.1	4,622	4,500	2.7
Waterwheels:									
Number	33	33	.....	26	18	.....	231	176	31.2
Horsepower	13,616	8,860	53.7	3,353	3,503	—4.3	144,055	68,766	109.5
Kilowatt capacity of dynamos	420,431	244,182	72.2	133,917	84,564	58.4	252,646	98,839	155.6
Output of stations, kilowatt-hours	1,083,514,202	399,101,309	171.5	317,581,985	149,008,819	113.1	517,539,925	215,402,974	140.3
Stationary motors served:									
Number	35,950	29,022	23.9	15,334	8,445	81.6	10,428	6,699	55.7
Horsepower	265,260	145,331	82.5	163,477	50,869	221.4	87,230	72,525	20.3
Number of street lamps:									
Arc	23,498	30,893	—23.9	5,569	5,504	1.2	7,305	9,187	—20.5
Incandescent, etc	49,042	20,168	143.2	20,981	9,567	119.3	25,783	10,888	136.8

* A minus sign (—) denotes decrease; percentages are omitted where base is less than 100.
† Exclusive of $10,190,446 in 1917 and $3,766,405 in 1912, reported by street and electric railway companies as income from sale of electric energy.
‡ Exclusive of $1,967,667 in 1917 and $568,641 in 1912, reported by street and electric railway companies as income from sale of electric energy.
¶ Exclusive of $892,146 in 1917 and $613,694 in 1912, reported by street and electric railway companies as income from sale of electric energy.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

E. S. J. A., Pacific Division.—This division of the Electrical Supply Jobbers' Association will meet at Coronado Beach, Cal., on April 28 and 29.

Ohio Electric Light Association.—Cedar Point, Ohio, is the place and July 15-17 are the dates fixed for the annual convention of the Ohio Electric Light Association.

Electric Club of Chicago.—Elmer D. Brothers had "The League of Nations" for the subject of his address given before the meeting of the Electric Club of Chicago held on April 3.

A. A. E., Kansas City Club.—J. E. Jacoby and R. N. Clarke were elected president and secretary respectively of the Kansas City Club, American Association of Engineers, on March 21.

San Francisco Electrical Development League.—J. D. Fernstermacher, sales manager of the Columbia Steel Company, gave an illustrated talk at the March 24 meeting of the league on "Making Steel Electrically."

N. E. L. A., New England Section.—C. R. Dooley of the Westinghouse Electric & Manufacturing Company gave a talk in Boston on March 21 before the New England Section of the National Electric Light Association, his topic being "The Work of the Westinghouse Company in the War."

Jovian Electric League, Kansas City.—The close relations between the Jovian Electric League of Kansas City, Mo., and the Chamber of Commerce were further cemented when on March 7 J. M. Guild, general secretary of the Chamber of Commerce, addressed the league on prospects of coöperative constructive work by the two organizations.

Ohio Electric Light Association.—Two reports, one by A. H. Bryant, Cleveland Electrical Illuminating Company, entitled "Scheduling Service Tests of Small-Capacity Alternating-Current Meters," and the other by J. L. Wright, Toledo Railway & Light Company, on "Training Men for Meter Work," will be presented at an open meeting of the meter committee of the O. E. L. A. in Dayton on April 18.

Seattle Joint Electrical Meeting.—Under the auspices of the local section of the A. I. E. E. a joint meeting of men of the electrical fraternity was held in Seattle on March 29 to hear Paul Lincoln, Westinghouse Electric & Manufacturing Company, on the subject of "The Development of Electrical Transmission," and John B. Fisken, Washington Water Power Company, on the subject of "Engineering—Its Opportunities and Its Responsibilities."

A. A. E., Pittsburgh Chapter.—F. E. N. Thatcher, 1312 Fulton Building, Pittsburgh, Pa., has been chosen as the secretary of the Pittsburgh Chapter of the American Association of Engineers.

N. E. L. A., Philadelphia Electric Company Section.—The April 8 meter department branch meeting of this section of the National Electric Light Association was addressed by R. T. Pierce, Westinghouse Electric & Manufacturing Company, on "Indicating and Graphic Instruments."

N. E. L. A. and A. I. E. E., Portland Sections.—At the March meeting of the Portland (Ore.) sections of the American Institute of Electrical Engineers and the National Electric Light Association Colonel Zinn read a paper on the organization and work of the North Pacific division of the government service, of which he is engineer.

Seattle Engineers Discuss Organization Problems.—A joint meeting of engineers was held in Seattle on March 27 to hear Calvin W. Rice discuss the problems which engineers face along organization lines. There were represented the American Society of Civil Engineers, American Society of Mechanical Engineers, American Institute of Electrical Engineers, American Chemical Society, Pacific Northwest Society of Engineers, American Institute of Mining Engineers and the Associated Engineering Societies of Seattle. There was a general discussion of the best plan for carrying out further organization of engineering societies in Seattle to the end that centralization and closer coöperation might be secured.

American Institute of Electrical Engineers

Toronto Section.—H. Lester Woodbridge presented a paper on "Storage Batteries" at the meeting of March 21.

Philadelphia Section.—Lieut.-Col. J. W. Hubbell, U. S. A., lectured on "Field Communication, First Army Corps, American Expeditionary Forces," at the March 10 meeting.

Pittsburgh Section.—The April 8 meeting was devoted to a talk by G. H. Kendrick, district supervisor of equipment Western Union Telegraph Company, about the new Pittsburgh quarters of that company, and a visit was made to the office itself.

Toledo Section.—E. H. Brown spoke on the growth of the Park Exchange of the Ohio State Telephone Company at the Feb. 27 meeting, and E. B. Thurston, Haughton Elevator Company, lectured on "General Operation of Electric Elevators" at the March 27 meeting.

Rochester Section.—At the meeting of the section held on March 28 H. A. Winne, General Electric Company, gave a lecture on "Electric Furnaces and Electric Welding." On April 25 Prof. V. Karapetoff of Cornell University is to be the speaker, while on May 23 E. Blough, Aluminum Company of America, will give a talk on "Commercial Applications of Aluminum."

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Rate Increase in Missouri.—In passing on an application of the Hamilton Light & Power Company for authority to increase rates the Missouri Public Service Commission laid down the following principles: Rates to certain classes of consumers, not yielding a full return but resulting in some profit to an electric utility, need not be increased, although the rates to other consumers are increased, as this commission will not allow the latter rates to be increased further on account of the failure to increase all rates. An electric utility having rates yielding approximately 4 per cent on an assumed investment of $40,000 is permitted to put into effect rates yielding a net income of 9 per cent for return and depreciation, in substance, per kilowatt-hour as follows: Commercial lighting: first 100 kw.-hr., 12 cents; next 50, 10 cents; next 50, 10 cents; all over 200, 9 cents; minimum charge, $1; commercial power: first 100 kw.-hr., 8 cents; next 100, 7 cents; all over 200, 6 cents; minimum charge per horsepower, $1. An increase in electric rates for commercial power service from 6 cents to 10 cents for the primary step is unreasonable and a rate of 8 cents is substituted therefor.

Wages for Plant Owners.—The Missouri Public Service Commission in granting increased rates to the Owensville Electric Light Company holds that an allowance of 50 cents per hour to each of two partners owning and themselves operating an electric plant as firemen, engineers and outside repairmen for such time as is actually devoted to such tasks is proper under present abnormal conditions, as the ownership of the plant should not estop them from receiving a fair wage for duty performed. The commission also ruled that an electric utility operating in a town of about 1000 inhabitants is required to give street-lighting service from dusk until 11 p.m., and Saturday service until 12 midnight, and from 5 a.m. until thirty minutes before sunrise from Oct. 15 to March 15, the commission not permitting a reduction of such service or requiring its extension to all-night service under the evidence presented. The following increased monthly rates per kilowatt-hour for electric service by a utility operating at an actual loss under existing rates in a town of 1000 inhabitants are deemed reasonable: Commercial lighting: first 50 kw.-hr., 15 cents; over 50, 10 cents; minimum, $1; street lighting; forty-five lights of 40 watts, $60; each additional light, $1.30.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Electrically Cooked Dinner for Louisville Company Employees.—An electrically cooked dinner was served to 130 employees of the Louisville Gas & Electric Company at the company's office recently. The object of the dinner was to stimulate interest in electric cooking. A. S. Witmer, commercial manager of the Louisville Gas & Electric Company, was in charge of the affair. The plan was to hold nine public demonstrations of electric cooking at suburban locations about Louisville during the following days.

Value in Scrap.—The Pacific Gas & Electric Company reports that war demands, and the unprecedentedly high prices arising therefrom, brought about an exceptional opportunity for the disposition of all kinds of scrap materials during the year 1918. Full advantage was taken of this condition, and there is to-day probably less scrap and discarded apparatus on the system than at any other time in the company's history. Total sales during the year of classified scrap, ranging all the way from platinum to old rubber boots and floor sweepings, aggregated more than 3,505,000 lb., for which $168,427 was realized.

New Jersey Power & Light Company to Resume Ice Manufacture.—When the Bernardsville Electric Light & Water Company was acquired by the New Jersey Power & Light Company, it was operating an ice plant in connection with the electric light plant. This ice plant had an ice-making capacity of 10 tons daily and was operated by steam. The New Jersey Power & Light Company operated the ice plant until it shut down the Bernardsville electric light plant. At that time it also shut down the ice-making plant, as it did not pay to run it for ice manufacturing only. Because of the natural ice shortage that will no doubt occur during the coming summer, due to the very mild winter, and therefore the excellent opportunities for the sale of artificially made ice, the New Jersey Power & Light Company will resume the manufacture of ice in the old plant, making use of one of the many improvements in the manufacture of artificial ice that have made their appearance since the plant was shut down—that of the raw-water process—a process by which an air system is used to agitate the water while it is being frozen. The plant will be operated by electricity instead of by steam, as formerly. Several inquiries and bids have already been received for taking the entire output.

Federal Propaganda in Public Schools.—The board of governors of the Associated Manufacturers of Electric Supplies has sent to members a pamphlet issued by the National Industrial Conference Board, entitled "A Case of Federal Propaganda in Our Public Schools." In writing to members, Charles E. Dustin, general secretary of the Associated Manufacturers, says that the purpose of the board in sending the pamphlet is to call to their attention specifically and directly what it believes to be a serious attempt of a partisan element in the federal government to disseminate its propaganda through the medium of the public schools. That the child who absorbs these teachings must obtain a warped view of social and economic relations and one utterly unfair to industry and ultimately productive of great harm seems obvious, Mr. Dustin adds. Members are urged to read the pamphlet carefully and to use their influence with their local school board to prevent the use of the lessons in question, about 3,000,000 copies of which have already been circulated. The National Industrial Conference Board will send the pamphlets on request. The address of this board is 15 Beacon Street, Boston, Mass.

Expansion of the Industry.—In the New York *Evening Post* "Utilities and Engineering Review," March 29, W. H. Hodge of H. M. Byllesby & Company writes: "A widespread, active construction period will hardly get under way in 1919, but next year should see unprecedented building, particularly of electric transmission lines, water power and steam-turbine power stations. . . . A time of wonderful expansion in the electrical industry cannot be long postponed, however, if the United States is to continue its course of industrial prosperity. The war brought to the foreground the dependence of modern production upon mechanical power and the superiority and economy of electrical power produced by large central stations. Every power company in a manufacturing district was seriously pressed to supply additional industrial demands during the war, and it is safe to say that nearly all of the new business gained or its equivalent will be permanently retained, and the demands for electric power will continue to grow with every factory expansion and the establishment of every new industry. The use of electricity in households also is a growing demand which in the aggregate is of enormous proportions."

National Foreign Trade Council Program.—Names of speakers at the Sixth National Foreign Trade Council, to be held in Chicago on April 24 to 26, have been announced. Among the speakers are: Fred I. Kent, vice-president Bankers' Trust Company, New York, "America's Financial Equipment for Foreign Trade"; Hugh Frayne, "Interest of Labor in Foreign Trade"; William Pigott, president Seattle Car & Foundry Company, "Element of Labor Costs in American Exports"; Edward Prizer, president Vacuum Oil Company, "Effect of Increased Productive Capacity Upon Our Foreign Trade"; William S. Culberson, United States Tariff Commission, "A Bargaining Tariff"; John M. Parker, president Mississippi Valley Association, "The Mississippi Valley and Foreign Trade"; J. W. Hook, president Allied Machinery Company of America, "Stabilizing Effect on American Industry of a Definite Foreign Trade Policy"; James E. Smith, president Missisippi Valley Waterways Association, "The Relation of Inland Waterways to Foreign Trade"; Frank O. Lowden, Governor of Illinois, "The Meaning of Foreign Trade to the Middle West"; James A. Farrell, president United States Steel Corporation, "An American Maritime Policy"; Breckenridge Long, Third Assistant Secretary of State, "The Relation of Diplomacy to Foreign Trade"; Edward N. Hurley, chairman United States Shipping Board, "Future of Our Foreign Trade."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Appeal from Commission.—The appellate jurisdiction of the Supreme Court is limited by the constitution to the review of decisions of the district courts or the judges thereof, and it cannot entertain an appeal directly from the Public Utilities Commission, according to the Supreme Court of Idaho (178 P. 271).

Review of Order of Commission.—Where an order of the Public Service Commission was affirmed by the Appellate Division on certiorari and the Court of Appeals denied an appeal, it was held by the Supreme Court of New York (174 N. Y. S. 708) that in subsequent proceedings to enforce the order of the commission the matter cannot be reviewed.

Company Liable for Injury to Trespassers.—Where the employees of an electric company, instead of removing wire not in use, attached the same to a high-power wire, and trespassers on the right-of-way, seeking refuge in a storm, came in contact with such wire, it was held by the Court of Appeals of Kentucky that the spring-gun theory applied and the electric company was liable. Where the employees of an electric company, instead of putting wire used for repair in a safe place, connected it with a high-power wire with the avowed intention of injuring thieves, it was held that such employees were not acting within the scope of their employment so as to render the employer liable, under the spring-gun theory, to trespassers who came in contact with the wires. (Craig vs. Kentucky Utilities Company. 209 S.W. 33.)

Men of the Industry

Changes in Personnel and Position—Biographical Notes

W. Dusenberry, formerly manager of the waterworks at Maryville, Mo., has been appointed manager of the Greenville district of the Southern Illinois Light & Power Company.

H. P. Blogdett, who for the past two years has been superintendent for the Central Maine Power Company at Gardiner, has been chosen to succeed A. C. Hopkins as superintendent of the Penobscot Bay Electric Company at Belfast, Me.

H. M. Ferguson, formerly superintendent of steam-heating operations of the Utah Power & Light Company, Salt Lake City, has been promoted to be manager of the Salt Lake division of the company. Mr. Ferguson has been associated with the company for somewhat more than two years, having before that been in charge of the commercial department and steam-heating business of the Missoula (Mont.) Light & Water Company. He went to the Missoula utility from the Westinghouse-Church-Kerr Company.

C. R. Young, sales manager of the Pacific Power & Light Company, Portland, Ore., has resigned his position with that company and will be associated with the securities selling department of the Electric Bond & Share Company, New York. Mr. Young has been with the Portland company for eight years and has been sales manager for three years. During that time he had charge of all the company's sales campaigns, including the sale of preferred stock to the company's customers. During 1918 the company sold $150,000 worth of its preferred stock to its customers and employees. It is understood that the Electric Bond & Share Company will extend the principle of security sales to customers into a number of its affiliated and controlled operating companies, the work being in charge of C. M. Hamilton. Mr. Young will be assistant in charge of this work and leaves the Pacific company on April 1.

D. W. Blakeslee, electrical engineer, formerly assistant superintendent of the Penn Electrical & Manufacturing Company, after having served in the Engineers, United States Army, has returned to his civil occupation with the Jones & Laughlin Steel Company, Pittsburgh, Pa. Mr. Blakeslee held his commission of first lieutenant for about two years. During his year in France he acted as company commander of Company A and Company C, Fifty-sixth Engineers, after which he did the scientific experimental and devolpment work of the American Expeditionary Force in connection with anti-aircraft searchlights and single-station sound-ranging apparatus. Since returning to the United States he has been stationed in the office of the Chief of Engineers, Washington, D. C. Mr. Blakeslee has specialized in mill and factory lighting and power applications. He is a member of the American Institute of Electrical Engineers, the Illuminating Engineering Society, the American Electrochemical Society, the Society for the Promotion of Engineering Education, the American Association for the Advancement of Science and the American Metric Association.

M. C. Osborn has severed his connection with the Washington Water Power Company, Spokane, Wash., as contract agent and is at present traveling in the East. Mr. Osborn has been associated with gas and electric utilities in the Far West for the past thirty-five years. He entered the utility field in 1894 with the Virginia City (Nev.) Gas Company, which he operated for twelve years. From there he went to Marysville, Cal., with the Yuba Power Company. When this property was absorbed by the Pacific Gas & Electric Company, Mr. Osborn continued with the latter company as advance man in explaining the system and policy of the company to the numerous communities served by it. Later he was employed by the Denver (Col.) Gas & Electric Company, from which he resigned to become business manager and manager of the gas works of the Butte (Mont.) Electric & Power Company. After two years here he entered in 1905 the service of the Washington Water Power Company, with which property he has continued up to the present time. Mr. Osborn has always been active in association work on the Pacific Coast. He was at one time president of the Pacific Coast Gas Association and in 1916 was elected president of the Northwest Light & Power Association. Mr. Osborn has also been a member of the electric range and water-heating committee of the Northwest association since its inception four years ago.

M. C. OSBORN

Obituary

John J. Cummins, formerly president of the Syracuse (N. Y.) Lighting Company and later chairman of the board of directors, died on March 17 at his home in Syracuse at the age of fifty-five years.

Prof. Carey Foster, the well-known English scientist, died Feb. 9 in his eighty-fourth year. He was professor of physics at the University College, London, from 1865 to 1898 and principal of the college from 1900 to 1904.

Harnett J. Fuller, who for some years maintained offices as a consulting engineer at Tacoma, Wash., died recently at Tacoma. Mr. Fuller came to the United States about twenty years ago from England and for a time was a member of the engineering staff of Stone & Webster at Boston.

Burnett C. Kenyon, formerly president of the Diehl Manufacturing Company and during the past two years purchasing agent for the Crocker-Wheeler Company, died suddenly from pneumonia at his home in East Orange, N. J., on April 5 at the age of fifty-four years. Mr. Kenyon had been associated with the electrical manufacturing industry for many years. He grew up in the Diehl company from salesman, through the general managership, to president. Before being employed with the Diehl company in the nineties, he was associated with the New York Electrical Equipment Company. Mr. Kenyon resigned from the presidency of the Diehl Manufacturing Company about four years ago and, after taking a long and well-deserved rest, again entered business, becoming associated with the Crocker-Wheeler Company.

Sir William Crookes, known throughout the world for his discoveries and researches in the realms of chemistry and physics, died in London, England, on April 4. He was born in 1832 and in college specialized in chemistry. His connection with the electrical industry dates back to his first important discovery in 1861, when he succeeded in isolating thallium. During the determination of its atomic weight in subsequent research he discovered the principle of "repulsion resulting from radiation." This led to the invention in 1875 of the radiometer for illustrating such phenomena. In this fashion he was brought to his famous researches on electric discharge in high vacuums. The tubes used have come to be universally known as "Crookes tubes." It is to this work that the world owes its present electronic theory. Sir William's researches led him into many fields, including rare earths and precious stones. He was knighted in 1897 and had been the recipient of many medals and other tokens of recognition of his work. He was a past-president of the British Institution of Electrical Engineers and the British Association for the Advancement of Science. Sir William's discoveries have had no small bearing on the late developments in the fields of radiotelegraphy, the X-ray and electric lighting.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies— Notes on Industrial Activities and Business Methods

IMPROVED MARKET FOR SECOND-HAND APPARATUS

Prices in Middle West Higher—Smaller Apparatus Moving Better than Larger Machinery

The volume of business in the second-hand market of the Middle West has improved materially in the last sixty days. While there is still small demand for units of 100 hp. and larger, the number of orders for the smaller material makes up for this. The second-hand dealers expect business to continue good.

As to prices, dealers say they are offering to pay more for machines than they were a few months ago. For a time offers on second-hand machinery were scarce and bids consequently were low. When it was learned that the government did not intend to sell $3,000,000 worth of motors it had on hand, the second-hand situation was considerably helped. These are not included in the government motors which it is reported are to be used in settling with munitions contractors.

Items that central stations buy are showing striking activity in comparison with that of the last few months. Meters, for instance, are quite active at prices not far out of line with those quoted in 1914. Induction meters of 5-amp. rating are selling at $7.

ABSORPTION OF EXCISE TAX ON FANS BY THE TRADE

Many Different Methods Employed by Manufacturers and Wholesalers to Take Care of 1918 5 per Cent Levy

In the absence of direct ruling regarding the collection of excise taxes on electric fans under the provision of the revenue act of 1918, passed in 1919, manufacturers have made certain provisions of their own for paying this tax. The government collects the tax on portable electric fans from the manufacturers. The method by which this tax is passed on to the wholesaler, to the dealer and finally to the consumer has been left, at least so far, to the discretion of the manufacturer.

Since the tax was imposed some manufacturers have issued new price lists which are 5 per cent higher than the old ones. Under this arrangement the tax does not appear as a separate item on the jobber's bill but is absorbed by the manufacturer. Other producers charge their former prices and add the tax separately.

The difference in the two plans can be shown as follows: By the first method a fan listing at $50 would be increased to $52.50. If the discount were 50 per cent, the jobber would then pay the $26.25 net and the manufacturer would pay the government 5 per cent on $26.25, which is $1.31, and would therefore receive $24.94 net for the fan. Under the second plan, where the list price is not changed, the manufacturer receives $25 net for the fan and shows the tax of $1.25 as a separate item on the bill. The jobber pays the same either way.

There are also manufacturers who are combining both plans. They bill the jobber the old price and add the tax separately but have issued new price lists 5 per cent higher for the use of dealers and users. Some jobbers are also issuing new price lists for their trade.

In changing lists by 5 per cent, however, manufacturers are careful not to claim that the increase is a tax increase. The 5 per cent tax is paid on the price received by the manufacturer and the government insists that on resale the customer must not be charged an increase for taxes which is greater in dollars and cents than is paid to the government. This does not mean, however, that the price cannot be increased for other reasons.

Attention has also been called to the fact that all fans are not taxed. Some manufacturers report that the government is only collecting the tax on oscillating and non-oscillating fans while exhaust fans, ceiling fans and hat-cleaning motors have been exempted.

SUITABLE COMPENSATION FOR WAREHOUSING LAMPS

Bookkeeping Costs Bring Request for Additional Compensation on Lamps Shipped from B Agents' Stocks During 1918

Representations have been made to the lamp manufacturers that sell on a consignment basis by jobbers for a further compensation for B agents on lamps shipped from jobbers' warehouses during 1918. Lamps shipped to customers from factory stocks are not to be included. There appears to be a disposition, it is reported, on the part of the producers to grant some such additional compensation to jobbers who have acted as something other than mere order takers. It is known that a compensation in the neighborhood of 1 to 2 per cent has been suggested. As yet, however, so far as can be learned, nothing definite has developed.

A request for an additional compensation on 1918 sales from agents' stock came as a result of the additional bookkeeping involved in the matter of prices. Price changes during the year caused the B agents no end of trouble.

While this is but a temporary condition, lamp manufacturers are very much opposed to the present form of compensation, which provides for a uniform discount to B agents based on the value of lamps sold during the year. For that reason there appears to be a possibility later of a change in compensation. Shipments from agents' warehouses may get a higher and more liberal compensation, while those agents relying wholly or partly on factory stocks may be proportionately penalized.

EFFECT OF ARTIFICIAL STANDARDS OF PRICE

Abridging of Economic Laws by Industrial Board Leads Sooner or Later to Instability in Business

When the new and lower iron and steel prices were announced a few weeks ago, it seemed as though the signal had been given for industry to proceed. In fact, that was what was expected when the Industrial Board was asked to lend its aid to stabilize the market by establishing a fair price. Numerous manufactured products made largely of iron and steel were reduced in price almost immediately. On other products producers were figuring costs preliminary to lowering prices during the opening days of April. Orders to go ahead on a number of building projects were given, and industry generally became quickened.

Then the railroad administration and other government and buying departments came forward with the statement that they had never promised to be bound by the board's

prices. In fact, the railroad administration does not purpose at the present time to pay the proposed price on rails but is asking for one much lower.

As a result industry is again hesitant. The lower prices still prevail, but buyers are waiting to see if this fundamental raw-materials market is to be free and open or virtually tied up by agreed prices to remain in force until 1920. Orders are again being held up and expected price changes are not forthcoming.

Each time there has been an attempt on the part of the government to abridge the laws of economics and establish false and arbitrary standards of price, business has found itself in a hesitant mood. During the war there may have been justification for such action to prevent profiteering.

Just now, however, when industry was beginning to find itself, when the retail trade was once more buying, when building was slowly opening up, when spring was starting the seasonal tide of business—in other words, after the worst is past—it is not so easy to understand why there should be this interference.

Such action might bring about confidence on the part of business in the immediate future, but what of the fall and winter months?

There are many who are calling for a free and open market in iron and steel. Such people believe in the fundamental laws of economics. They believe that industry will be strengthened if it cures its own ills. It does seem now that business generally will be on a better basis with less chance for future hesitation if such artificial standards are not utilized.

METAL MARKET SITUATION

Most Metals Show a Continued Upward Tendency with Market Stability

In the last five weeks the tone of the copper market has changed from one of depression to one of considerable optimism. It is about that length of time since the metal stopped declining in price and struck its low level just under 15 cents, which level it maintained for about two weeks. It gradually rose through 15 cents and 15¼ cents to 15½ cents a pound and remained at that latter figure for two weeks. During this time the sales of copper exceeded the previous months of the year and gave evidence of a rather hopeful outlook for the immediate future. The reversal met by the Industrial Board through the Railroad Administration has affected the whole metal market appreciably.

In the past week prices have continued to show upward tendencies in several metals. Antimony, spelter and aluminum have increased slightly, and in the old-metal market scrap copper is moving constantly upward, and with it is going brass.

This upward tendency all along the line has given the market a much stronger tone.

NEW YORK METAL MARKET PRICES

	April 1	April 8
Copper:	£ s d	£ s d
London, standard spot	78 0 0	79 0 0
	Cents per Pound	Cents per Pound
Prime Lake	15.75	16.00
Electrolytic	15.50	15.50
Casting	15.25	15.30
Wire base	17.25 to 18.00	17.25 to 18.00
Lead, trust price	5.25	5.25
Antimony	6.62½	6.80
Nickel, ingot	40.00	40.00
Sheet zinc, f. o. b. smelter	10.00	10.00
Spelter, spot	6.55 to 6.60	6.52½
Tin	Govt. price 72.50	Govt. price 72.50
Aluminum, 98 to 99 per cent	29.00	30.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	13.00 to 13.25	13.50 to 13.75
Brass, heavy	7.25 to 7.50	7.50 to 8.00
Brass, light	6.00 to 6.50	6.50 to 7.00
Lead, heavy	4.25 to 4.50	4.25 to 4.50
Zinc, old scrap	4.25 to 4.75	4.25 to 4.75

THE WEEK
IN TRADE

FROM all sections of the country comes evidence of the strong expectation of increased business activity in the near future. The biggest cause for this feeling appears to be in the resumption of building activities noted throughout practically all the states. Not that so much has already been started, but contracts have been let and work is about to start.

Reports from jobbers indicate that March business has generally been better than business for last March. Especially has the retailer found this true for household appliances. The industries in some sections are expanding, and line work is being carried on in the West and Middle West especially. In general, conditions in the electrical trade show a more settled tone.

Labor troubles are smoothing out, and men in many sections of the country are returning to work. Collections are continuing to come in in a satisfactory manner.

NEW YORK

New building should be stimulated by the announcement last week that the contractors' price of cement alongside the docks in New York has been reduced 50 cents per barrel. Forty cents of this is for bags. As an additional help to investors it is planned to put building financing on a definite basis by the establishment of a national building bank to be operated under existing laws and as a part of the Federal Reserve banking system. Brooklyn is working out a coöperative apartment-house proposition.

The labor supply in the state is not greatly in excess of the demand, but the condition in New York City is made worse because many soldiers who are discharged in this district come to the metropolis instead of returning to their homes. Labor in general is much quieter.

Collections are better than before the war because the stringent credit requirements of the war are still being maintained in many instances and sellers are not taking chances. Manufacturers and jobbers have refused to sell to old customers who were rated by their collection departments as slow pay.

MOTORS, LARGE AND SMALL.—Standard speed alternating-current motors up to 50 hp. are now in stock, but direct-current motors are not so plentiful. One manufacturer took last week an order for $150,000 worth of motors and rotaries for a new industrial plant. There is very little demand for the unprecedented stock of new alternating-current motors up to 500 hp. in the warehouses of Eastern machinery dealers. Manufacturers' deliveries on such motors have been cut practically in half since the signing of the armistice.

FRACTIONAL-HORSEPOWER MOTORS.—The demand is greater than supply. One manufacturer is quoting three to four months' delivery. Another expects to catch up with back orders in sixty days.

FANS.—Manufacturers are building up large stocks, and 1919 fan sales are expected to beat all records. One manufacturer has secured more orders this year to date than ever before. The industrial and residential use of fans this year is expected to more than offset the large government purchases of 1918. The general use of four-blade portable fans during the war is being continued. The demand for ceiling fans is falling off.

SOCKETS.—Jobbers report large sales to fixture manufacturers. This business is earlier than might have been expected from conditions in the building trade.

FRICTION TAPE.—One line was reduced about 35 per cent and another line dropped about 15 per cent within the past three weeks. These changes brought the price of both brands practically together.

IRONS.—The list prices of two more makes of irons have been reduced 50 cents each. The manufacturers' stocks are said to be below normal. This is not a reduction in the Hoskins schedule. On large orders it is reported that manufacturers now above schedule prices are quoting as low as the schedule.

STEEL REFLECTORS.—Prices are being maintained, but sales are light.

RUBBER-COVERED WIRE.—There is practically no change in the bases quoted this week, 20 cents prevailing. The demand, however, for the product is showing an improvement, but most of it is purchased for the West.

GALVANIZED WIRE.—Galvanized stranded wire and telephone wire both dropped about 5 per cent within the last three weeks.

POLE-LINE MATERIAL.—Orders for line hardware and cross-arms have increased noticeably during the past month, but there has been little movement in poles.

CHICAGO

The past week has been quiet, with a firm, steady undertone. A general air of optimism pervades all selling organizations, based not so much on orders that are being closed as on the unmistakable signs that central stations are quite active. Line construction, plant betterments and all sorts of work are going ahead. Telephone work is said to be a little more active than central-station work. Where central-station companies did not have munition industries to serve they have put off doing all kinds of work until now it has become absolutely necessary to do some of it. Some jobbers report a better business in March, 1919, than in March, 1918, although the feeling is that profits have not been so large. The tendency is very marked for dealers to put more efforts on specialties than on other lines on account of the slowness in building.

Nevertheless, there seems to be a considerable amount of activity in the building field, as is evidenced by reports of building permits. Up to a few weeks ago the building permits of the city of Chicago ran about $200,000 or less per week. For the week ended March 5 they showed a total of $1,124,100. The month of March has showed a volume of building permits which is twice what it was in March last year and is the biggest month in more than two years.

COPPER WIRE.—The market has been a little steadier this week with an upward tendency of prices. During the price changes the market was somewhat active. Rubber-covered and weatherproof are both on a 20-cent base.

NON-METALLIC FLEXIBLE CONDUIT.—This product is down about 35 per cent compared with what it was at the time the armistice was signed.

FLEXIBLE METALLIC CONDUIT.—This product has declined slightly.

WASHING MACHINES.—It has been reported that about $25,000,000 worth of washing machines were sold during 1918. The demand continues to be great.

SHOW-WINDOW REFLECTORS.—A campaign which is being conducted in show-window reflectors is producing excellent results.

FLOODLIGHTING PROJECTORS.—While it was expected that the bottom would fall out of the projector market when the armistice was signed, the effect has not been so great as was then expected. Quite a steady business in standard lines has developed, and while this demand is not so active as it was during the war time, it is very much better than was expected. Furthermore, so many of these units were put out during the war that quite an active business in parts has developed.

TURBINES.—The high prices of coal will probably dictate the installation of a number of turbines within the next six or twelve months in plants which had previously installed units around 2500 kw. Units of this size which were bought about six years years ago show a steam rate of around 21 lb. or 22 lb., while new units which might be bought to replace them would show around 15 or 16 lb.

MOTORS.—In the fractional-horsepower sizes for domestic appliances the demand continues strong.

LIGHTING FIXTURES.—There will apparently be an opportunity to sell a considerable quantity of lighting fixtures to banks in view of the way building operations are being opened up by these financial concerns. There are at least ten banks in Chicago that are contemplating building, and a score or more in the surrounding agricultural country have asked bank architects in Chicago to submit propositions.

BOSTON

Business holds up reasonably well, although not much large work is being done at present. Collections are a little slow, without much change compared with last week. Circular-loom discounts are showing considerable fluctuation, apparently due to local competition. The smaller contractors are getting busier as the season advances. Building operations are still greatly restricted by high prices of labor. It was announced last week that Henry Ford is negotiating for a 50-acre tract in Boston upon which to build a plant capable of employing at least 15,000 persons. The General Motors Company is also to build a five-story service station on the edge of the Back Bay district.

Jobbers' stocks are fairly large at present, with few exceptions. Galvanized conduit is a little short in supply, and conduit shows a tendency to run low in smaller sizes. Prices are off four or five points. Other material and equipment prices hold up steadily, and wire seems to have reached a low point for the present. Labor conditions are rather unsettled. Textile outputs are reported to be rapidly increasing in the Berkshire district of Massachusetts, with the prospect of the early resumption of night work. The printing trade is exceedingly active at Boston just now, and the demand for improved motor drives is a feature of the market. Small motors of the direct-current type are in considerable call.

FARM-LIGHTING SETS.—Stocks are well filled and inquiries are increasing. The outlook is good for an active season. At a convention at the factory of a prominent manufacturer of these equipments it was announced that present prices will hold through 1919.

WIRE.—A large number of small wiring jobs are being handled, but no shortage of wire is reported. Stocks appear ample to meet the present demand, with room for considerable expansion as well. Rubber-covered wire is being quoted on a 20-cent base this week.

SEWING-MACHINE MOTORS.—These are moving well, and an exceptionally good year is anticipated.

CONDUIT.—Smaller sizes of pipe are in somewhat increased demand, and the supply appears to be a trifle low. Galvanized pipe in particular is reported as somewhat scarce. A new card (No. 42) has been published, giving reductions of four to five points.

ELECTRIC TRUCKS.—Interest in road trucks continues to increase and some sales are being made. A meeting to stimulate trade and secure broader coöperation among dealers is scheduled for the Engineers' Club, Boston, at 8 p.m., April 17, under the auspices of the electric vehicle committee of the New England Section of the N. E. L. A.

LIGHTING FIXTURES.—The demand is increasing for fixtures for mercantile service. Prices show little evidence of decreasing at present, in view of the cost of brass and of labor. Local stocks are being well maintained. One Boston agency sold $60,000 worth of fixtures last year and is making plans for double this business this year. It will be some time, apparently, before all fixtures purchased before the armistice are disposed of. Novelties are in fair demand.

WASHERS AND CLEANERS.—Trade holds up well, and a brisk campaign is yielding excellent results in Maine.

MOTOR-DRIVEN COAL-LOADING EQUIPMENT.—Sales are increasing somewhat and inquiries are coming in well. A representative make shows about 10 per cent reduction in the latest quotations, effective April 1, due in part to easier prices of steel and other material involved. Stocks are in good shape for immediate delivery, and sales are well scattered.

ELECTRIC RADIATORS.—These are showing little movement at present, but a spurt in trade is looked for shortly, when furnace fires are let out.

ATLANTA

A more pronounced feeling of optimism pervades the Southeast this week. Following a reduction in price of certain staple metal products, an increasing stimulation in orders and inquiries is noted, while transactions in general, covering a wide line, are being well maintained. On the whole, the outlook this week shows a marked improvement over the past few weeks. The majority of manufacturers report continued activity and the manufacture of seed and peanut-crushing equipment for export trade is becoming a large factor in this section. Wholesale and retail trade is good and still ahead of the previous year. The tendency to await lowering of prices seems to be gradually disappearing. Labor troubles so far are scattered.

That normal conditions are returning rapidly is evidenced by a tentative survey of realty and building conditions in Atlanta. Real estate transfers for the first quarter of 1919 show an increase of 22 per cent over the first quarter of 1918, and cash transactions 20 per cent, breaking all records since 1915. Building permits over the same periods increased 30 per cent, and their value increased 57.2 per cent. The average value of permits for the first quarter of 1918 amounted to $1,936, and for 1919, $2,370, indicating that building operations are assuming larger proportions. In addition to this activity, it is reported that a new two-million-dollar hotel, a four-hundred-thousand dollar theater and a five-hundred-thousand-dollar business building will be started soon.

CONDUIT.—A decline of five points is noted for black and white conduit this week. Manufacturers and jobbers report that the demand is growing rapidly. This is accounted for to some extent by the sporadic requirements from industrial sources. Stocks are in excellent condition, especially at Birmingham and New Orleans. Quick shipments are being secured from Eastern points. Fittings have sagged about 5 per cent, followed by an increasing number of inquiries, which have tended to liven an otherwise stagnant market. Local stocks are ample and shipments good.

STEEL-ARMORED CABLE.—Prices are off 10 per cent, and manufacturers have been flooded with inquiries and orders. In one quarter the volume and value of transactions are 50 per cent over last week. Stocks are somewhat low, but factory shipments are coming through on good time.

STAMPED STEEL BOXES.—A reduction of 10 per cent was recorded in these and a sluggish market has been stimulated.

FLEXIBLE STEEL CONDUIT.—A slight improvement is noted over the previous week. Jobbers are expanding their stocks. This is reflected in larger orders received by the manufacturers. This week's quotations are five points off the prevailing market. No difficulty is being experienced in securing prompt factory shipments.

SEATTLE—PORTLAND

Seattle jobbers as a whole report business slow during the past week. Retailers state that sales of electrical appliances, particularly ranges and washing machines, show a slight increase over the past two weeks. Jobbers give as a reason for the small sales volume the fact that prior to the shipyard strike, even prior to the armistice, various yards had purchased in excess of their needs. Now they are absorbing that surplus. With one or two exceptions Seattle yards, both steel and wooden, are operating full blast, running day and night shifts.

Commercial business is picking up, although it has not reached the peak volume attained before the shipyard strike. Apparently prospective purchasers of electrical machinery and equipment are still cherishing false illusions in thinking that prices will drop to the pre-war status. Jobbers are of the opinion that prices will drop, but that the process will be so slow as to be hardly noticeable. However, new industries are awaiting this very thing, and so are rural central stations which are planning extensions and betterments. Lumbering and logging interests are buying some electrical equipment, but not to the extent they would were prices lower. It is believed that with lower prices these industries will gradually change from steam to electric operation.

As a whole the electrical industry reports collections good. This applies to rural dealers as well as those in Seattle and other Puget Sound cities. No new extensions of credit or new credits of any particular significance were made during the past week.

Retail electrical interests in Portland state that business in their line was appreciably better for the month of March than for the same month last year. This also represents business in all lines of electrical merchandising.

Increased activity in construction of residences in Portland and towns throughout the state has been noted in the past ten days. Business conditions, on the whole, are more conducive to optimism than they were a month ago. The non-employment situation throughout Oregon has considerably improved.

DOMESTIC APPLIANCES.—Seattle dealers report a slight increase in sales of ranges and washing machines. It is believed this increase will continue until well into the summer. Sales of labor-saving devices this spring have been larger than originally anticipated. Stocks in most cases are reported in excellent condition. Many sales show marked decrease due to the coming of spring and longer days, the daylight-saving plan and the elimination of night shifts in some plants heretofore engaged in war work.

MOTORS.—Sales of larger sizes are light, while smaller sizes are moving in a comparatively satisfactory way, although not in the volume expected with the opening of the lumbering and logging industry. Stocks are in good condition and prices are firm.

SAN FRANCISCO

The machinists' strike in the San Francisco yards has been arbitrated, and the men are returning to work. For the present at least, the big shipyards will continue in operation. In other directions the labor situation is quiet. A proposed master electrician bill has been tabled by the California Assembly.

Building is a little brisker than during last month under the stimulation of slightly lower prices in building material and in electrical supplies. The United States government is discontinuing the cantonment at Camp Fremont, about 35 miles from San Francisco, and a vast quantity of lumber and other supplies will be thrown on the market.

WEATHERPROOF WIRE.—The market has been unsteady for several weeks, the base price in coil lots now being 22 cents a pound with very little demand.

RUBBER-COVERED WIRE.—The coil price of rubber-covered wire No. 14, single-braid, is now about $12.50 per 1000 ft. A big increase in demand is reported, and large stocks are being accumulated in expectation of the building boom anticipated about the middle of the year. The demand for larger sizes than No. 12, with the exception of a certain call for No. 6, the range-wiring size, is small, and sales of circular-mil wire are negligible.

SCHEDULE MATERIAL.—Switches and plates are slow. Sockets, especially brass-shell sockets, are moving steadily, although in smaller lots than the average order of last year. A job requiring about 100 hospital signals is reported by the Marine Hospital on the San Francisco government reservation, and several other hospital wiring jobs are in sight, owing to the determination of various California counties to erect their own sanitariums to take care of tuberculosis and other infectious diseases.

FLASHLIGHTS.—Dealers report an increased demand for flashlights and batteries, probably because of the spring conditions that influence campers, trampers and sportsmen.

VIBRATORS.—The long wet winter has produced many cases of rheumatism, neuritis and similar diseases, so that drug stores all over the state are stocking vibrators.

IRONING MACHINES.—A more intensive effort is being made to sell ironing machines, and new sources of distribution are being sought. Several large department stores are now handling them. The popular size in California is the 42-in. size, although in the Middle West it seems to be a 46-in. size.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit.

Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List per 1000 Ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	10%
	No. 12 Solid
Less than coil	List
Coil to 1000 ft	10%

Twin-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	10%
	No. 12 Solid
Less than coil	List
Coil to 1000 ft	10%

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	+20%
Coil to 1000 ft	List
	No. 12 Solid
Less than coil	+20%
Coil to 1000 ft	List

Twin-Conductor

	No. 14 Solid
Less than coil	$115.00
Coil to 1000 ft	100.00
	No. 12 Solid
Less than coil	+20%
Coil to 1000 ft	List

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	15%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+30% to List
1/5 to std. pkg	+5% to 20%
Std. pkg	18% to 36%

BATTERIES, DRY
NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.45—$0.46	$0.45—$0.47
12 to 50	.40	.40— .41
50 to barrel	.35— .36	.36— .37
Barrel lots	32— .329	.33— .339

BATTERIES, DRY—Continued
CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.45	$0.45
12 to 50	.38	.38 to $0.39
50 to barrel	.35 to $0.362	.35 to .372
Barrel lots	.326 to .332	.326 to .342

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
⅜	250	$5.00
½	250	7.50
¾	100	10.00
⅞	50	13.00
1	50	21.00
1¼	50	26.00
1½	25–50	35.00
2	25–50	45.00
2½	25–50	52.00

NET PER 1000 FT.—NEW YORK

	Less than Coil	Coil to 1000 Ft.
⅜-in. single trip	$75.00	$63.75— 69.75
⅜-in. double strip	75.00— 82.50	72.00— 75.00
½-in. single strip	100.00	85.00— 93.00
½-in. double strip	100.00—110.00	96.00—100.00

NET PER 1000 FT.—CHICAGO

	Less than Coil	Coil to 1000 Ft.
⅜-in. single strip	$75.00	$63.25 to $63.75
⅜-in. double strip	78.25 to $78.75	71.25
½-in. single strip	100.00	75.00 to 85.00
½-in. double strip	105.00	93.00 to 95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
7/32	$0.05½	1	$0.25
⅜	.06	1¼	.33
½	.09	1½	.40
⅝	.12	1¾	.47
¾	.15	2	.55
⅞	.18	2½	.65

NET PER 1000 FT.—NEW YORK

	Less than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	$25.00	$20.00	$18.00
½-in.—	30.00	24.00	21.00

NET PER 1000 FT.—CHICAGO

	Less than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	$60.00	$30.00	$26.00–26.50
½-in.—	65.00	32.00–32.50	29.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 40

Size, In.	Conduit, List per Foot
⅛	$0.08½
¼	.08½
⅜	.08½
½	.11½
1	.17
1¼	.23
1½	.27½
2	.37½
2½	.58½
3	.76½

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
⅛	$0.05	$0.19
¼	.06	.19
⅜	.07	.19
½	.10	.25
¾	.13	.37
1	.17	.45
1¼	.21	.50
1½	.28	1.10
2	.40	1.80
2½	.60	4.80
3		

DISCOUNT—NEW YORK

	¼ in. to ½ in.	¾ in. to 3 in.
Less than 2500 lb.	7% to 12.1%	9% to 14.1%
2500 to 5000 lb.	10% to 15.1%	12% to 17.1%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	¼ to ½ In.	¾ to 3 In.
Less than 2500 lb.	+3%	+1% to 2%
2500 to 5000 lb.	+1% to 2%	+4%

(For galvanized deduct six points from above discounts.)

FLATIRONS
NEW YORK

List price	$7.00 to $7.50
Discount	20% to 25%

CHICAGO

List price	$6.35 to $7.50
Discount	20% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	30%
1/5 to std. pkg.	41%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	30%
1/5 to std. pkg.	40% to 41%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	$6.00 to $8.75
1/5 to std. pkg.	5.50 to 7.00

Standard packages, 500. List, each, $0.07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	$8.00
1/5 to std. pkg.	7.00

Standard packages, 500. List each, $0.07

LAMPS, MAZDA OR TUNGSTEN

110 to 125 Volts

Regular, Clear:	Std. Pkg.	List Each
10 to 40-watt—B	100	$0.35
60-watt—B	100	.40
100-watt—B	24	.85
75-watt—C	50	.70
100-watt—C	24	1.10
200-watt—C	24	2.20
300-watt—C	24	3.25
Round Bulbs, 3½-in., Frosted		
15-watt—G 25	50	.60
25-watt—G 25	50	.60
40-watt—G 25	50	.60
Round Bulbs, 3½-in., Frosted:		
60-watt—G 30	24	.82
Round Bulbs, 4¾-in., Frosted:		
100-watt—G 35	24	1.15

DISCOUNT—NEW YORK

Less than std. pkg	List
Std. pkg	10%

DISCOUNT—CHICAGO

Less than std. pkg	List
Std. pkg	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$35.18
Coil to 1000 ft	25.94

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$31.00—$36.00
Coil to 1000 ft	24.00— 27.00

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	$33.00

CHICAGO

Net per 100	$33.00

OUTLET BOXES

Nos.	List per 100
101—A, A 1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200, S.E., 300, A.X., 1½, 4 S.	30.00
103—C.A., 9, 4R, B 1½	25.00
106—F.A., 7, C.S., 1½, 3 R	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	26%–38%	20%–33%
$10.00 to $50.00 list	36%–47%	31%–43%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	20%–32%	10%–27%
$10.00 to $50.00 list	30%–40%	20%–35%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	10%
1/5 to std. pkg	20%
Std. pkg	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	5%
1/5 to std. pkg	15%
Std. pkg	25%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg	$15.00 to $17.00
1/5 to std. pkg	12.00 to 14.00

Standard package, 2200. List per 1000, $21 to $34

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg	$21.00–$24.15
1/5 to std. pkg	17.85– 21.00

Standard package, 2200. List per 1000, $20.00

PORCELAIN KNOBS

NEW YORK

Per 1000 Net.	Std. Pkg. 3500. 5½ N.C.—Solid Nail-it—N.C.	Std. Pkg. 4000 N.C.
Less than 1/5 std. pkg	$16.00	$22.00
1/5 to std. pkg	13.60	18.00

CHICAGO

Per 1000 Net.	Std. Pkg. 3500. 5½ N.C.—Solid Nail-it—N.C.	Std. Pkg. 4000 N.C.
Less than 1/5 std. pkg.	$13.00–$18.40	$32.00–$36.80
1/5 to std. pkg	11.50– 16.00	27.20– 32.00

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
½-in. cap key and push sockets	500	$0.33
½-in. cap keyless socket	500	.30
½-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	List
1/5 std. pkg	List to 10%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T	$0.80
60-amp. S. P. S. T	1.20
100-amp. S. P. S. T	2.25
200-amp. S. P. S. T	3.48
300-amp. S. P. S. T	5.34
30-amp. D. P. S. T	1.20
60-amp. D. P. S. T	1.78
100-amp. D. P. S. T	3.38
200-amp. D. P. S. T	5.20
300-amp. D. P. S. T	8.00
30-amp. 3 P. S. T	1.80
60-amp. 3 P. S. T	2.68
100-amp. 3 P. S. T	5.08
200-amp. 3 P. S. T	7.80
300-amp. 3 P. S. T	12.00
Low Grade:	
30-amp. S. P. S. T	$0.42
60-amp. S. P. S. T	.74
100-amp. S. P. S. T	1.50
200-amp. S. P. S. T	2.70
30-amp. D. P. S. T	.68
60-amp. D. P. S. T	1.22
100-amp. D. P. S. T	2.50
200-amp. D. P. S. T	4.50
30-amp. 3 P. S. T	1.02
60-amp. 3 P. S. T	1.84
100-amp. 3 P. S. T	3.76
200-amp. 3 P. S. T	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+15%
$10 to $25 list	2%
$25 to $50 list	5%
	Low Grade
Less than $10 list	+5%
$10 to $25 list	8%
$25 to $50 list	15%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+25%+15%
$10 to $25 list	+10% to 2%
$25 to $50 list	+5% to 5%
	Low Grade
Less than $10 list	+15% to +5%
$10 to $25 list	2% to 8%
$25 to $50 list	5% to 15%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0.28
5-amp. single-pole, ind	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P	100	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

SWITCHES, SNAP AND FLUSH—Continued

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	15% to 17%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+30% to list
1/5 to std. pkg	+5% to 10%
Std. pkg	8% to 18%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	18%	List
$2.00 to $10.00 list	28%	5%
$10.00 to $50.00 list	45%	10%

DISCOUNT—CHICAGO

	Galvanized	Black
Less than $2.00 list	25% to 40%	20% to 30%
$2.00 to $10.00 list	25% to 50%	20% to 40%
$10.00 to $50.00 list	25% to 64%	20% to 52%

TOASTERS, UPRIGHT

NEW YORK

List price	$6.00 to $6.50
Discount	20% to 25%

CHICAGO

List price	$6.35 to $7.00
Discount	20% to 30%

WIRE, ANNUNCIATOR

NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0.38
No. 18, full spools	.36

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0.53 to $0.90
No. 18, full spools	.47 to .64

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$14.15–$14.50	$10.50–$12.65	$10.50–$10.60
12	$18.18	18.18	$13.64
10	24.30	24.30	16.20
8	33.12	27.60	22.08
6	52.50	43.75	35.00

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14	$18.00–$20.00	$13.00–$15.00	$11.50–$13.00
12	17.50– 21.63	17.55– 21.63	17.55– 18.54
10	24.05– 28.91	24.05– 28.91	21.16– 24.78
8	33.35– 39.34	33.35– 33.72	29.35– 33.72
6	52.95– 61.74	46.60– 52.92	46.60– 52.92

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 3 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb	$25.25
25 to 50 lb	25.25
50 to 100 lb	24.25

CHICAGO

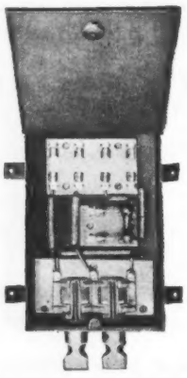
	Per 100 Lb. Net
Less than 25 lb	$23.75 to $35.75
25 to 50 lb	23.75 to 34.75
50 to 100 lb	23.75 to 37.35

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Lighting Plug Box

The lighting plugging boxes now being manufactured by the Leonard Electric Manufacturing Company, Cleveland, Ohio, are arranged to be placed in convenient places in shops or rooms for connecting portable lights. They are designed for simplicity and

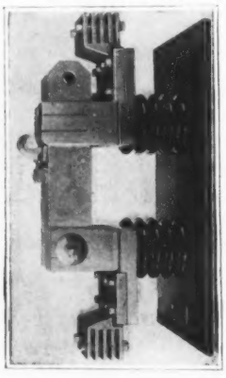


FOR CONNECTING PORTABLE LAMPS IN A SIMPLE MANNER

to withstand long and rough usage. The boxes contain mountings for four fuses, a switch, contacts for the plug and the necessary wiring connections. Drilling is provided for either loom or conduit as desired. The boxes are rated at 15 amp. and 110 volts.

Adjustable High-Rating Disconnecting Switches

In heavy-capacity bus structures the cost of installing disconnecting switches can be materially reduced if means are

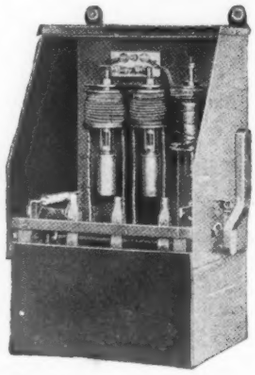


SEPARABLE TERMINAL AVOIDS BENDING OF BUSBARS

provided for eliminating the necessity of bending buses to line up with fixed heights of switch contacts. With the unit-type 4000-amp. switches manufactured by the Delta-Star Electric Company, 2433 Fulton Street, Chicago, the separable terminals are made in various heights and numbers of bus slots, so that by selecting a terminal of the proper size bending of the bus is unnecessary. A further adjustment in height between switch base and contact can be secured by raising the insulator supports by means of standard base fillers under the insulator units. With this adjustable switch the cost of installation can be maintained at a minimum figure.

Oil Starters for Polyphase Motors

For starting squirrel-cage motors where conditions do not necessitate using auto-starters or compensators, the Condit Electrical Manufacturing Company of South Boston, Mass., is making type G-1 oil starters, which



HANDLE RETURNED TO "OFF" POSITION WHEN COVER IS REMOVED

are applicable to alternating-current motors of 5-hp. to 35-hp. size. In the construction of these starters all live parts, coils and mechanism have been inclosed in a dust-proof case. The cover and oil tank are easily removable, permitting inspection or the making of wiring connections. When the cover is removed the handle returns to the "off" position, thus eliminating possibility of danger to a repairman. Interchangeable, reversible "knockout" plates placed in the top of the starter and on the side opposite the operating handle accommodate a wide range of sizes and combinations of conduits.

In operating these starters the handle is thrown into the position marked "start," and with the movable contacts in the starting position the overload coils are excluded except when motors are started "star-delta." After the motor has arrived at synchronous speed the handle is shifted quickly into the running position, which includes the trip coils in the motor circuit. To stop the motor the tripping lever placed on the front of the starter is thrown upward.

This arrangement, the manufacturer points out, permits the overload coils to be set at a sufficiently low value to protect the motor against overloads and single-phase running, and also precludes the motor from being disconnected during the starting period by the excessive starting current. Time limits prevent the starter from being disconnected on momentary current surges in excess of the overload setting.

Durably Constructed Direct-Current Generating Sets

For lighting and power service in factories, hotels and office buildings, for dredges, steam shovels and magnet cranes, for marine lighting, etc., Engberg's Electric & Mechanical Works of St. Joseph, Mich., are manufacturing direct-current generating sets in 1-kw. to 50-kw. size.

Accessibility and ease of adjustment of all working parts have been aimed at in designing the engines used in these sets. Removable side doors on each side of the engine frame allow access to the cross-head, wrist pin and all adjacent parts, while the hand-hole plates on the opposite side of the frame allow the lower end of the connecting rod to be reached. The piston and rod, the connecting rod, the cross-head, the

STRONGLY CONSTRUCTED, COMPACT SET

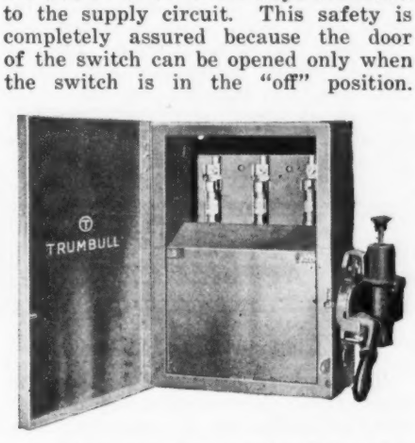
crank shaft and the valve are all said to be well made, simplicity and strength being features. The governor controls

the speed within 2 per cent from no load to full load. Should it be necessary to change the engine speed, means are also provided for changing the tension on the governor springs.

These dynamos are of the multipolar type and customarily compound-wound for 115 volts. The shunt and series coils are separate and form-wound of cotton-covered magnet wire. The commutator is made of copper bars insulated with mica plate and is very heavy to insure long and continuous operation without renewal. It is built upon a separate sleeve and bolted to the armature drum so that the shaft can be removed without disturbing the windings.

Motor-Starting Switch with Safety Shield

In order to insure safety to the electrician who re-fuses motor-starting switches the Trumbull Electric Manufacturing Company of Plainville, Conn., is placing a shield of non-conducting material over the parts of the switch which are always connected to the supply circuit. This safety is completely assured because the door of the switch can be opened only when the switch is in the "off" position.



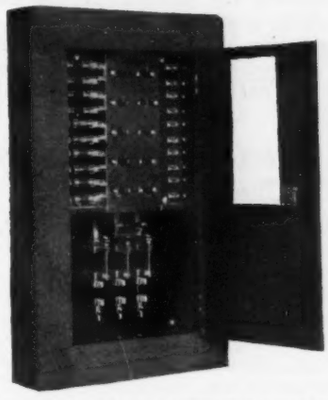
NO LIVE CONTACTS CAN BE TOUCHED WHEN RENEWING FUSES

The shield is hinged to the side or bottom of the switch box and can only be opened by the electrician who has access to the box, which is kept locked. A seal indicates whether or not the switch has been tampered with.

The switch illustrated herewith is equipped with an undervoltage release coil inclosed in a dust cap, but the shield can also be adapted for use with the ordinary manually operated knife switch made by this company.

Safety-Type Lighting Panels

With the safety-type lighting panels being manufactured by the Leonard Electric Manufacturing Company, Cleveland, inexperienced persons may operate the circuits without any danger of getting shocked or burned. For while the switch buttons are always accessible, the fuses and the main switch, should one be used, are protected by the door of the locked cabinet. The switches used in these panels are standard 10-amp. push-button type, of rugged construction, and are covered over with a steel plate through which the buttons



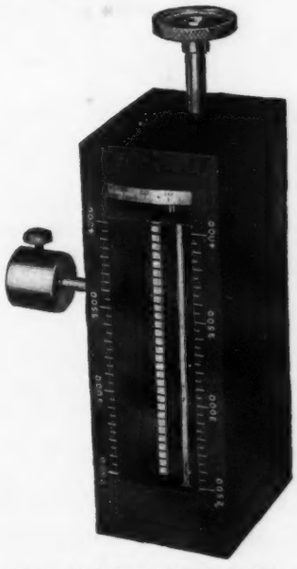
LOCKED DOOR BARS ACCESS TO LIVE PARTS

alone protrude. Arrangements are made for either N. E. C. or open-link fuses, the maker states, since the fuses are normally inaccessible and experienced men can replace open-link fuses with sufficient safety.

Snap switches are also supplied in place of the push-button type if desired. These lighting panels are obtainable in two-wire, 110-volt double-branch style and in three-wire, 110-220 volt type. They are furnished for from two to twenty-four circuits, with main switch ratings of 30 amp. to 100 amp. and with fused switch in mains, with switch in mains, with fuse in mains, or with main lugs only.

Instrument for Determining Vibration

The development of high-speed rotating machinery has made the question of vibration of great importance because it may cause excessive wear and



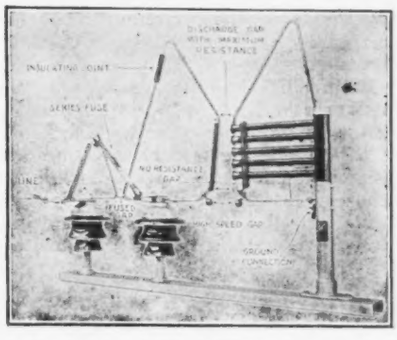
INDICATES AMPLITUDE OF VIBRATION (INSTRUMENT SITTING ON ONE END)

tear on the machine, noisy operation and vibration of surrounding structures. A reed-type instrument known as the "Jagabi Vibrometer" is being marketed by James G. Biddle, 1211 Arch Street, Philadelphia, which indicates both the frequency and amount of vibration. This instrument, as shown herewith, has, in addition to an r.p.m. scale, an amplitude scale located at right angles to the former. An index wire is provided, which, supported by a turnable frame and two posts, can be set by means of the projecting knurled head so as to indicate the amplitude of vibration of the reeds. A counterweight is used to increase or decrease the amplitude of vibration.

The most frequent causes of vibration, such as improper balance of rotating parts, improperly assembled or aligned bearings, pulsations of steam in blades and piping of turbines, and improper fitting of carbon or metallic packing in impulse turbines, may be detected with this instrument. The instrument is especially desirable for comparative tests.

Lightning Arrester with Fuse

Combining the advantages of the series fuse with those of an auxiliary gap, lightning arresters are now being made by Schweitzer & Conrad, 4431 Ravenswood Avenue, Chicago. The



AUXILIARY GAP PROTECTS CIRCUIT WHEN SERIES FUSE HAS BLOWN

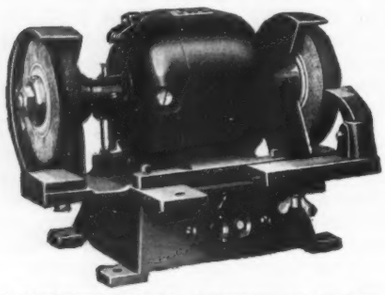
series fuse used in these arresters is mounted at the necessary 45-deg. operating angle so that it is readily accessible with fuse tongs from the grounded end of the arresters or from a point below the arresters. This fuse is shunted by an adjustable auxiliary gap, the latter becoming effective only when the fuse blows, thus avoiding the non-protection of the circuit until the fuse has been replaced. The arrester is regularly furnished with 25-amp. fuses for voltages up to 25,000, while for service above 25,000 volts 10-amp. fuses are furnished. Fuses of other ratings can be furnished if desired.

Motor-Driven Tool Grinders

Electrically driven tool grinders in both floor and bench types have just been developed by the Janette Manufacturing Company, Singer Building, New York City, and 617 West Jackson Boulevard, Chicago. The ¼-hp. motors used with these grinders are furnished for alternating and direct current in

all voltages and have a speed of 3500 r.p.m. with an ample overload capacity. Connection is made to any lamp socket by a 6-ft. (1.8-m.) extension cord. Located in the base of the grinders directly below the motor is a push-button switch which is designed to withstand hard use.

Spindles are made of 90-point carbon



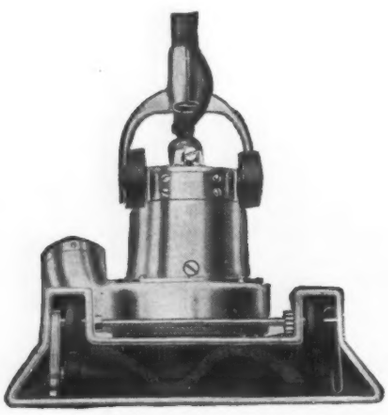
OCCUPIES SMALL AMOUNT OF SPACE

steel, hardened and ground to size. Hard-drawn phosphor-bronze bearings are standard equipment, but S.K.F. ball bearings can also be obtained. Grease and wick-type lubrication is employed, an oil cup being installed on the upper bearing which is arranged with holes for returning the oil back into the oil well. Heavy guards protect the grinding wheels two-thirds of their circumference and can easily be removed when occasion demands.

Both bench and floor models accommodate two ¾-in. by 5-in. (19-mm. by 127-mm.) grinding wheels. The height of the floor type is 46 in. (1.1 m.) and its weight 105 lb. (47.6 kg.), while the bench type is 10 in. (0.25 m.) high and weighs 55 lb. (24.9 kg.). The width of each grinder is 14 in. (0.35 m.).

Positive Gear-Driven Vacuum Cleaner

Removing threads and lint without injuring the carpet by means of a positive gear-driven floating brush is the

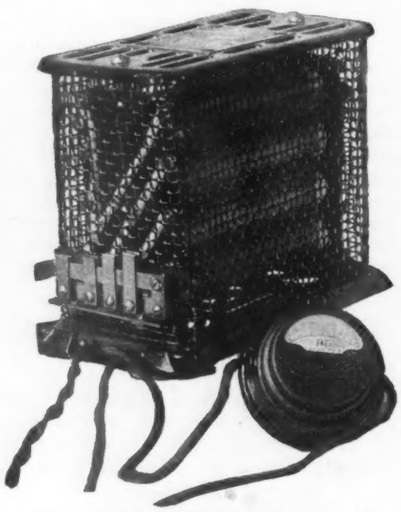


HEIGHT OF NOZZLE ADJUSTED BY KNOB ON COLUMN

feature of the vacuum cleaner being marketed by the Regina Vacuum Cleaner Company, 47 West Thirty-fourth Street, New York City. Carpets and mattresses can be thoroughly cleaned, according to the makers, by regulating the position of the suction nozzle to meet various conditions. The illustration shows the construction and the method of brush drive. This brush can be easily removed for cleaning.

Direct-Current Battery-Charging Rheostat

Where the voltage of an available charging circuit is much higher than that of the battery to be charged, some method must be used for reducing the voltage the necessary amount. For use on direct-current lines of 110 volts the France Manufacturing Company of Cleveland, Ohio, has recently developed a charging rheostat with charging rates of 1½, 3, 4½ or 6 amp. for batteries ranging from 2 volts to 18 volts. The back pressure from a battery of higher voltage than this causes only a slight reduction in the ampere charg-



GIVES CHARGING RATES OF 1½, 3, 4½ OR 6 AMP.

ing rates. The rheostat consists of a series of high-resistance coils together with a current-regulating switch for varying the charging rate. An ammeter, a long extension cord and plug, charging leads and battery clips complete the outfit, which is finished in black enamel, weighs about 10 lb. (4.5 kg.) and has dimensions of 5 in. by 7 in. by 9 in. (12 cm. by 17 cm. by 22 cm.). This rheostat can be used on current furnished by 24-volt or 32-volt direct-current farm-lighting plants for charging ignition batteries of automobiles, tractors, etc.

Combination Hot-Water Bottle Heater and Curling Iron

An interesting appliance is being marketed by the Christian Heater Sales Company, 532 Grand River Avenue, Detroit, Mich., in the form of a combination curling iron and hot-water-bottle heater. It consists of the electric heater proper, a curling-iron handle and a heat-regulating switch. To use the heater in a regulation water bottle it is screwed into the neck of the bottle and the plug is inserted in any light socket with direct or alternating current at 90 volts to 125 volts. The heat is regulated by the switch at three temperatures — high,

THREE HEATS OBTAINED BY SWITCH

low and medium. It is pointed out that after the water is heated to the desired temperature it may be maintained at that degree without the water boiling by shifting the switch to a lower heat. Also it is said that the heat has a tendency to keep the rubber of the bottle soft and pliable. The heater is inserted into the handle for use as a curling iron and the temperature controlled by the regulating switch.

NOTES ON RECENT APPLIANCES

Electric Hair Cutter

The Barbers' Electric Specialty Company, 4204 Troost Avenue, Kansas City, Mo., is marketing an electrical hair-cutting machine which operates from a trolley.

Renewable Fuses

The construction of the National renewable fuses made by the Federal Sign System (Electric), Lake and Desplaines Streets, Chicago, has been improved.

Lighting Plants

Assembled in fifteen, twenty and twenty-five-light units, Aerothrust lighting plants are being marketed by the Aerothrust Engine Company of Laporte, Ind.

Clothes-Washing Machine

The Wash-Easy Company, Fourteenth Street and Western Avenue, Chicago, is manufacturing an improved model of the rocker-type Wash-Easy "Copper" washer.

Two-Header Superheaters

Stationary power-plant steam superheaters for application to all fire-tube or water-tube-type vertical or horizontal boilers are now being marketed by the Locomotive Superheater Company, 30 Church Street, New York City, and People's Gas Building, Chicago.

Trade Notes

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

The A. B. Knislingeverken, Knislinge, Sweden, importers and exporters of electrical machinery, desire to make connections with American manufacturers.

A man in France (No. 28,787) desires to secure an agency for the sale of electrical apparatus and electrical cars for factories. Correspondence should be in French.

A company in Italy (No. 28,789) desires to secure an agency for the sale of electrical apparatus. Correspondence may be in English.

A firm in Italy (No. 28,782) desires to secure an agency for the sale of electrical heating and cooking devices, such as stoves, flatirons and boilers. Correspondence may be in English.

A man in the Azores (No. 28,784) desires to secure an agency and possibly purchase all articles and supplies connected with the construction and installation of a hydroelectric plant of 3000 hp. and the construction and equipment of an electrical railroad system of approximately 50 miles. Correspondence may be in English.

A firm in Brazil (No. 28,788) with a branch office in New York City wishes to secure exclusive agencies for the sale of electrical supplies.

A British Indian company (No. 28,794) with buying headquarters in New York City wishes to purchase direct from manufacturers. Payment will be made against documents in New York.

A firm in France (No. 28,813) desires to purchase and also secure an agency for the sale of electrical apparatus and equipment, such as heaters, private telephone lines, electromedical equipment, motors, transformers and rheostats. Correspondence should be in French.

A company in France (No. 28,817) desires to secure an agency for the sale of electrical equipment. Correspondence may be in English.

An electrical engineer in France (No. 28,826) desires to secure an agency for the sale of electrical motors and electrical apparatus. Correspondence should be in French.

A firm in Italy (No. 28,834) desires to secure an agency for the sale of electric welders, butt and spot. Correspondence may be in English.

A firm of commercial agents in Italy (No. 28,838) desires to secure an agency with a stock of goods for the sale of electrical fittings. Quotations should be given f.o.b. New York or port nearest to manufacturer. Cash will be paid. Correspondence may be in English.

A firm in Ecuador (No. 28,841) desires to receive catalogs, either in English or Spanish, of electrical materials, wire, lamps, fixtures, etc.

A man in Italy (No. 28,848) wishes to secure an agency for the sale of electrical appliances. Correspondence should be in Italian.

An agency is desired by a man in Italy (No. 28,851) for the sale of electrical machines. Correspondence may be in English.

A merchant in France (No. 28,868) desires to secure an agency for the sale of electrical apparatus. Correspondence should be in French or Spanish.

An editor of a newspaper in Greece (No. 28,881) desires to purchase printing-press machinery and electric motor to operate. The buyer wishes catalogs with full information regarding prices and terms. Payment will be guaranteed through bank.

A man in France (No. 28,889) wishes to purchase or secure an agency for the sale of electrical supplies. Correspondence should be in French.

A Norwegian company (No. 112,342) is in the market for an electric generator of 5200 kw., alternating current, with the auxiliary machinery, to be delivered and installed in the company's power station at Svelgen, in Bremanger. If the machinery proves satisfactory after delivery and use, opportunity will be given to bid for larger orders, as the power available is more than 30,000 hp., so that later electrical machinery aggregating 33,000 kw., with turbines to correspond, will be installed. Blueprints of the generator may be examined at the Bureau of Foreign and Domestic Commerce or its district offices.

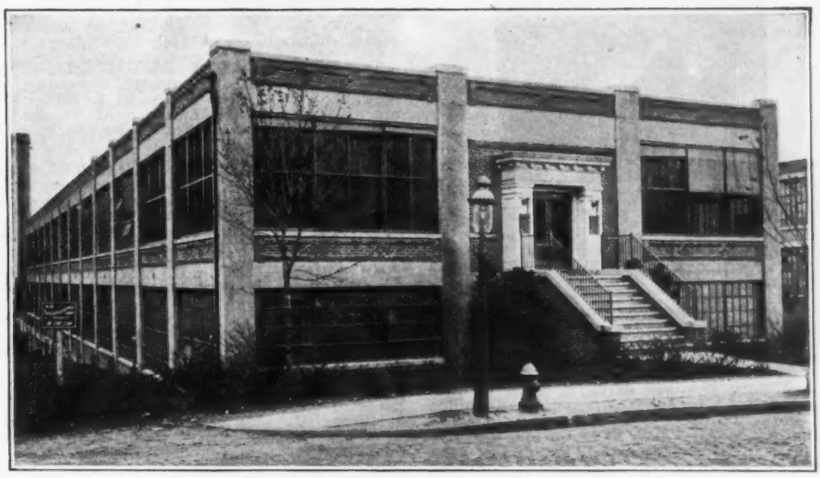
WESTINGHOUSE JOBBER - AGENTS TO MEET.—It is reported that Westinghouse jobber-agents are to meet in Del Monte, Cal., from May 4 to May 11.

REVISED FREE LIST.—"Free List" is now applicable to exportations to Denmark, Norway, Sweden, Holland, Finland, Switzerland, Luxemburg and the occupied Rhine territory, and licenses for exportation of electrodes and iron or steel lighting fixtures will be issued.

BRITISH IMPORTS.—The Comptroller of Import Restrictions lists the following articles for admission freely under general license: electrodes, telephones and telephone parts except telephone brackets and parts, telephone switchboards and parts and brass terminals for electric fuse boards.

CATALOGS WANTED.—The Purchasing Agents' Association of Northern California, with headquarters at San Francisco, is starting, for the benefit of its members, a general catalog file. The association, through its secretary, D. B. Gray, 230 California Street, San Francisco, invites manufacturers and dealers generally to send complete sets of their latest catalogs and trade publications to the above address. Catalogs covering machinery, mechanical goods, hardware, iron and steel products, etc., are especially requested.

THE CHELTEN ELECTRIC COMPANY, Philadelphia, has recently occupied its new factory at 4859-65 Stenton Avenue. The company is prepared to market a line of plug cut-outs which have just been approved by the Underwriters' Laboratories and is arranging to manufacture several new types of switch boxes and outlet boxes.



THE CHELTEN ELECTRIC COMPANY'S NEW FACTORY IN PHILADELPHIA

T. W. BEHAN, for the last twenty years with the General Electric Company, Fort Wayne, Ind., has resigned to accept the position of factory manager of the 1900 Washer Company at Binghamton, N. Y. Mr. Behan has for many years been in charge of the fractional-horsepower motor-sales department of the Fort Wayne plant of the General Electric Company. He was presented with a handsome leather traveling bag by his department associates. He is succeeded by A. H. Francis, who has been with the Chicago office of the General Electric Company for a number of years.

W. J. HUDDLE & COMPANY, Chicago, announce that an organization headed by W. J. Huddle and doing business under the above name has taken over the business formerly carried on by Sloan, Huddle, Feustel & Freeman, consulting engineers. For the past two years Mr. Feustel has been president of the Fort Wayne & Northern Indiana Traction Company and has given the larger portion of his time to this work. In the future he will devote all of his attention to street railway operation and advisory engineering work in this field and will be stationed at Fort Wayne, Ind. W. F. Sloan is connected with the Post Office Department as advisory telephone engineer. W. J. Freeman also retires from the firm but will continue in consulting engineering. Mr. Huddle, who was actively connected with the various lines of work carried on by the old firm now has associated with him a number of the old organization, and other former members of the staff will probably rejoin him as soon as they are released from military service. W. J. Huddle & Company will continue to specialize in public utility matters and are now in a position to undertake work in all of the lines in which the organization formerly engaged. Their offices will continue at 1745 Conway Building, Chicago.

THE TERRY STEAM TURBINE COMPANY, Hartford, Conn., announces that its reduction gears are again on the market. They were not obtainable during the last year owing to the concentration of the company almost entirely on turbines for destroyers.

B. A. WAGNER, manager of the Electric Agencies Company, Inc., has secured the Pacific Coast agencies for the Collyer Insulated Wire Company, manufacturer of rubber-covered and weatherproof wire, and the Tubular Woven Fabric Company, manufacturer of "Duraduct."

GEORGE K. HEYER is the new assistant telephone sales manager of the Western Electric Company, having been advanced from the position of railway sales engineer. He has been with the company in New York since 1902 and will remain there with headquarters at 195 Broadway.

E. I. DU PONT DE NEMOURS & COMPANY, Wilmington, Del., announce the transfer of T. E. Doremus to the E. I. du Pont de Nemours Export Company as general Eastern manager with headquarters in Shanghai, China. E. R. Galvin succeeds Mr. Doremus as manager of the sporting powder division.

THE ELECTRIC BUREAU, INC., Park Row Building, N. Y., is the recently incorporated American branch office of the Elektrisk Bureau of Christiania, Norway, importers and wholesale distributers of electrical household appliances, labor-saving devices, supplies for high and low tension and lighting units.

R. D. HARRINGTON has joined the staff of the Electric Storage Battery Company's New England sales office, with headquarters at Boston, and will devote special attention to the industrial electric truck market. Mr. Harrington was graduated from Tufts College, department of electrical engineering, in 1915, and for the past ten months has been on the electrical staff of Fay, Spofford & Thorndike, designing engineers of the Boston army base. His earlier experience included a term of service in the engineering department of the Cumberland County Power & Light Company, Portland, Me.

FIRST LIEUT. S. A. KOENIG of the Coast Artillery has been discharged from the service and has joined the forces of the Advance Machinery & Supply Company, Denver, Col., as sales engineer. Lieutenant Koenig was graduated from the electrical engineering department of the University of Colorado in 1913 and has spent about four years in the employ of the General Electric Company, Schenectady, N. Y. The last two years of this time was spent in

the experimental department. The Advance Machinery & Supply Company is Western representative for electrical specialties and mine, mill and power-plant supplies.

THE HURLEY MACHINE COMPANY of Chicago has opened a shop under the name of the Thor Electric Shop at 908 Walnut Street, Des Moines, Iowa. Charles A. Ellen, who has been department manager in the Chicago office, will be in charge.

RUSSELL C. TIRRELL has been appointed quality manager of the Hygrade Lamp Company, Salem, Mass., succeeding George W. Fox, resigned. Mr. Tirrell entered the company's service about a year ago, and was an assistant in the quality department at the time of his promotion.

J. E. KEARNS, who has been placed in charge of the St. Louis office of the General Electric Company, was born in 1880. Upon his graduation from the University of Michigan he started to work for the General Electric Company, and he has constantly retained his connection with that concern over sixteen years. During that time he has worked in the testing, direct-current designing, power and mining and

J. E. KEARNS

lighting departments. In May, 1916, he was transferred to the company's Chicago office, and in the fall of 1918 he was appointed manager of apparatus sales for the Chicago district, which position he retained until January of 1919, when he was appointed manager of the St. Louis office of the company. Mr. Kearns has a wide acquaintance and has had considerable experience in the electrical field, having represented his company as technical engineer for several years on the electrical apparatus committee of the National Electric Light Association, of which committee he is now an honorary member. He was among those instrumental in the preparation of the handbook on overhead-line construction published by the National Electric Light Association, and he gave material assistance in the preparation of the American Institute of Electrical Engineers' rules.

THE UNDERWRITERS LABORATORIES, Chicago, according to W. H. Merrill, the president in "Safeguarding America Against Fire," inspected approximately 100,000,000 items of material, machinery and supplies ordered by the government for war purposes. For the Navy Department the Laboratories inspected 1,000,000 ft. of lead-covered cable, and for the Quartermaster's Corps 7500 acres of roofing were tested, besides fire extinguishers, fire doors and electrical appliances of various kinds.

E. L. SIMPSON has been appointed manufacturing superintendent of the Fort Wayne (Ind.) plant of the General Electric Company. He has spent the last two years at Fort Wayne, going there from Schenectady, N. Y. He will have for his two assistants Max Holz and A. Kaysor. Mr. Holz went to the Fort Wayne plant from Madison, Wis., where he was employed as a special designer. He had also held the same position at Fort Wayne. Mr. Kayser for some time has been superintendent of section A of the Fort Wayne plant, or that part of the works east of Broadway.

Trade Publications

SERIES SOCKET.—A circular devoted to the "Kyle" series socket has been issued by the Line Material Company, South Milwaukee, Wis.

ANODE HOOK.—The "Ever Ready" anode hook is described in a folder of the Niagara Insul-Bake Specialty Company, Niagara Falls, N. Y.

REFLECTORS AND FITTINGS.—Reflector Hand Book No. 11, describing Burr reflectors, is being circulated by the A. B. Wilson Company, Leader-News Building, Cleveland, Ohio.

INDICES.—Dated April, 1919, an index to its descriptive bulletins and sheets and one to its supply-part bulletins have been published by the General Electric Company, Schenectady, N. Y.

SAFETY PANELS AND CABINETS.—Bulletin No. S-10 from the Penn Electrical & Manufacturing Company of Irwin, Pa., contains information about Penn safety panels and cabinets.

STEEL POLES.—A mailing folder about its steel poles for various services has been prepared by the Bates Expanded Steel Truss Company, Continental & Commercial Bank Building, Chicago.

WOOD PRESERVATION.—"Long Life for Wood at Low Cost" is the title of a booklet recently issued by the Barrett Company which tells when, where and how to use "Carbosota" Creosote Oil.

REFILLABLE FUSES.—A folder about the refillable cartridge fuses made by A. F. Daum, 1157 Hodgkiss Street, Pittsburgh, Pa., has been issued, as well as a leaflet about the Daum refillable fuse plug.

DIRECT-CURRENT AMMETERS.—The Weston Electrical Instrument Company of Newark, N. J., sets forth, in a folder of recent issuance, the features of its model 354 direct-current ammeters for automobile use.

DIRECT-CURRENT AMMETERS.—Flush and surface type direct-current ammeters are shown and described in a new folder from the Ballman-Whitten Manufacturing Company, 440 Olive Street, St. Louis, Mo.

SUPERHEATERS.—Its new superheaters for stationary power plants have been described and illustrated in detail by the Locomotive Superheater Company, 30 Church Street, New York City, and People's Gas Building, Chicago, in bulletin No. T1.

BATTERY-CHARGING EQUIPMENT.—Bulletin 24 issued by the France Manufacturing Company, Cleveland, Ohio, contains descriptive matter about "F-F" battery-charging equipment. Bulletin 25 of this company is a new price list for these "battery boosters."

INDUSTRIAL APPARATUS.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., announces the issue of five separately bound catalogs, Nos. 30, 33, 36, 38 and 45, covering industrial apparatus, to supersede No. 3002. These cover direct-current motors and generators, alternating-current motors, control apparatus, small motors and generators and mill, crane and hoist motors.

STEAM-BOILER COMBUSTION.—Written in a clear and simple manner, the book entitled "Principles of Combustion in the Steam-Boiler Furnace," issued by the Babcock & Wilcox Company, New York, outlines the principles involved in the study of what happens in the combustion chamber of furnaces. Fundamentals of the chemistry of combustion are given and formulas are developed which show the relation between temperatures, volumes and pressures. Discussing density, weight and volume of gas, heat of combustion, specific heat, temperatures developed in combustion, air and combustion, Arthur D. Pratt, the author of the booklet, constructs the formula of the air required for combustion. Combustion losses and smoke are discussed and methods of reducing these losses are given. In case formulas and derivations prove too complicated for the reader he can still get invaluable information from the examples of how to determine the amount and speed of the air. In addition combustion data are given for coal, oil, natural gas and by-product coke-vein gas. The computations involved in the determination of the distribution of losses in a boiler test—that is, the heat balance—are carried out in full.

PLUGGING BOXES.—Bulletin "G," issued by the Leonard Electric Company, Cleveland, Ohio, has for its subject plugging boxes for light and power.

VACUUM CLEANERS.—The Regina Vacuum Cleaner Company, 47 West Thirty-fourth Street, New York City, has prepared a circular giving the features of Regina vacuum cleaners.

METAL REPLENISHER FOR LINOTYPES.—The Fortified Manufacturing Company of Kansas City, Mo., has prepared a booklet describing its electric "Metalfeed" for type-casting machines.

METAL PARTS.—A two-color folder is being distributed by the Maximum Silencer Company, 81 Homestead Avenue, Hartford, Conn., showing the various complicated parts which can be produced from steel tubing by the Maxilent process.

MOLDED INSULATION.—"C-H Molded Insulation" is the title of a new two-color, sixteen-page booklet which describes "Thermoplax" and "Pyroplax," the heat and fire resisting insulations made by the Cutler-Hammer Manufacturing Company of Milwaukee, Wis. Numerous photographs illustrate more than 200 different pieces molded from these materials. They include such pieces as attachment plug and cord connector parts, heater connectors, ignition wire spacers, switch and starter bases, stove, hot-plate and heater bases, marine wiring devices, switch and rheostat handles, radiator caps, and a 24-in. field rheostat base. The booklet gives the physical properties and characteristics of these two materials and describes the method of manufacture.

New Incorporations

THE HOUSTON-GUADALUPE WATER POWER COMPANY of Houston, Tex., has been incorporated with a capital stock of $200,000 by H. A. Halverton, F. T. Beadle, C. L. Kolb and others.

THE EMPIRE ELECTRIC & MACHINE COMPANY of Terre Haute, Ind., has been chartered with a capital stock of $25,000 to manufacture electrical specialties. The incorporators are Charles F. Behringer and C. A. Epling.

THE E. J. WIGGINS ELECTRICAL CORPORATION of Buffalo, N. Y., has been incorporated by E. J. Wiggins, C. G. Babcock and R. Seimer. The company is capitalized at $75,000 and proposes to manufacture electrical apparatus and appliances.

THE STANDARD LIGHTING & HEATING COMPANY of Springfield, Mass., has been incorporated with a capital stock of $50,000 to manufacture heating and lighting appliances. The incorporators are Arthur G. Taylor, Ralph H. Benson and R. L. Meyer.

THE MANUFACTURERS' EQUIPMENT EXCHANGE of New York, N. Y., has been incorporated by R. Grant, H. E. and A. C. Ackerly, 914 Ditmas Avenue, Brooklyn, N. Y. The company is capitalized at $50,000 and proposes to manufacture motors, electrical equipment, boilers, etc.

THE NORTHERN OHIO HYDROELECTRIC COMPANY of Ashtabula, Ohio, has been incorporated by George R. McKay, Raymond R. Oliver and others. The company is capitalized at $300,000 and proposes to build a hydroelectric plant in Astabula County to supply electricity in Ashtabula.

THE UNITED GAS IMPROVEMENT CONTRACTING COMPANY. United Gas Improvement Building, Philadelphia, Pa., has been organized as a subsidiary of the United Gas Improvement Company to manufacture gas and electric appliances and equipment. Paul Thompson is president of the company.

THE CENTRAL ELECTRIC TOOL COMPANY of Pittsburgh, Pa., has been chartered with a capital stock of $5,000 by John A. Metz, 2800 Espy Avenue, Dormont, Pa.; S. E. Wentley, West Elizabeth, Pa., and John H. Martin, Bridgeville, Pa. The company proposes to manufacture electrical appliances, machines and devices.

New England States

HIRAM, ME.—The bill introduced in the State Legislature by Senator Charles E. Gurney, providing for improvement of storage and reservoir conditions on the Saco River, would make possible a development of 38,000 hp. on that river. The project would include not only development of the storage basin at Hiram but also that of the Great Ossipee. The cost of the work is estimated at $1,978,000.

FAIRHAVEN, VT.—The Western Vermont Power & Light Company has secured a number of contracts for furnishing electricity to operate a number of creamery plants in this section.

WEST BROOKFIELD, MASS.—The Town Council is considering plans for extensions to the street-lighting system. The service is supplied by the Central Massachusetts Electric Company of Palmer.

NORWICH, CONN.—The Gas and Electric Commissioners have entered into a contract with the Admore Woolen Company to erect a new electric transmission line to Yantic to supply additional power to the company. About 5 miles of wire will be strung. The cost of the work is estimated at $20,000 to $25,000.

PUTNAM, CONN.—Arrangements have been completed by the Nightingale-Morse Mills, Inc., for the construction of a hydro-electric plant to supply electricity to operate its mills.

Middle Atlantic States

COBLESKILL, N. Y.—Considerable electrical equipment will be required in connection with the proposed improvements and alterations in the home economics building at the Schoharie State School of Agriculture. D. D. Frisbie is president of the board of trustees.

JAMESVILLE, N. Y.—Considerable electrical equipment will be required in connection with the installation of the new refrigeration plant in the Onondaga County Penitentiary, for which contract was recently awarded.

MINEOLA, N. Y.—Arrangements it is reported, are being made by the Nassau Light & Power Company for improvements to its system in Manhasset. The company is also contemplating extensions to its street-lighting system in the Port Washington district.

NIAGARA FALLS, N. Y.—Plans are being prepared by Mills, Rhines, Bellman & Nordhoff, architects, of Toledo, Ohio, for extensions to the plant of the United States Light & Heat Corporation on Highland Avenue. The company manufactures batteries, electric lighting equipment, etc.

POUGHKEEPSIE, N. Y.—Notice has been filed with the Public Service Commission by the Central Gas & Electric Company of an increase in capital stock from $2,500,000 to $2,600,000, to provide for extensions.

TOMPKINSVILLE, N. Y.—Bids will be received at the office of the lighthouse inspector, Third District, Tompkinsville, until April 23, under proposal 4161, for furnishing motors, etc., to convert Niles bending rolls.

WESTFIELD, N. Y.—Plans have been filed by Armour & Company of Chicago, Ill., for the construction of a new factory in Westfield. Arrangements have been made for the construction of a power plant in connection with the project. The cost of the entire work is estimated at $300,000.

DOVER, N. J.—Negotiations are under way between the New Jersey Power & Light Company and the Newton (N. J.) Gas & Electric Company whereby the former will furnish the latter with electricity for distribution in Newton and vicinity. This will require the erection of 12 miles of 33,000-volt, three-phase transmission line and a substation, which the Newton company will own.

TRENTON, N. J.—The Public Utility Commissioners have granted the Trenton & Mercer County Traction Corporation permission to issue $200,000 in bonds, part of which will be used for extensions and improvements. The proposed work will include the installation of new equipment to cost about $10,000; new generating unit for power plant, $20,000; for the installation of a system for the mitigation of electrolysis, $10,000; a new pit lighting system, $1,000, and other improvements.

LEHIGHTON, PA.—The Mauch Chunk & Lehighton Transit Company is contemplating the purchase of new equipment for its power plant, and is also planning improvements to its power lines. Ives & Davidson, 61 Broadway, New York, N. Y., electrical engineers, are in charge of the work.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

PHILADELPHIA, PA.—The Western Electric Company has filed plans for the alterations and improvements in its building at 1100 York Street. Contract has been awarded to the Matthews Company.

HAGERSTOWN, MD. — Arrangements have been made by the Maryland Smelting & Refining Company of Hagerstown for the construction of a metal-concentrating plant, with electrical and other equipment. A one-ton brass melting furnace will be installed.

QUEENSTOWN, MD.—The Town Commissioners have decided to secure electricity from the municipal plant at Centerville to operate the local electric lighting system. The electric transmission line will be erected by the Town Commissioners of Queenstown. The municipal generating plant has been closed down for several weeks.

BLUEFIELD, W. VA.—The question of improvements and extensions to the ornamental lighting system is under consideration by the Chamber of Commerce.

MILLVILLE, W. VA.—The Northern Virginia Power Company of Winchester is contemplating building an addition, 50 ft. by 57 ft. and 33 ft. by 50 ft., to its local plant.

WINDSOR, W. VA.—The Wheeling Electric Company, controlled by the American Gas & Electric Company, is planning to build an addition, about 200 ft. by 300 ft., to its local plant. The proposed extension will be equipped with three steam-driven generating units having a capacity of about 180,000 kw. The cost is estimated at about $1,000,000.

WASHINGTON, D. C.—P. T. Moran has been made chairman of a committee appointed by the Chamber of Commerce to make investigations and report upon the improvement of Great Falls as a power site.

WASHINGTON, D. C.—Bids will be received by the Procurement Division, Purchase Section, Radio Branch, Room 2542, Munitions Building, Washington, D. C., until April 15, under requisition 1130-1, CP, for furnishing 60 loop radio-telegraph sets, spark type, SCR112. Further information may be obtained at the above office.

WASHINGTON, D. C.—Bids will be received at the United States Soldiers' Home, War Department, Washington, D. C., until April 24, for furnishing a 500-kw. turbo-generator. Specifications and further information may be obtained upon application to the secretary-treasurer of the United States Soldiers' Home, Washington, D. C.

WASHINGTON, D. C.—Bids will be received at the Post Office Department, Washington, D. C., until April 29 for furnishing electrical supplies, including motors, carbons and fuses, as they may be ordered for the use of the postal service from time to time during the fiscal year beginning July 1, 1919, and ending June 30, 1920. Blanks for proposals with specifications can be obtained upon application to the purchasing agent.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until April 22, for furnishing at Philadelphia, Pa., Mare Island, Cal., and Charleston, under Schedule 3894, miscellaneous bronze copper and brass wire. Bids will also be received until April 29, under Schedule 3897, for furnishing at South Brooklyn miscellaneous solid wire, condulets, tape sockets, sheet copper, copper rods, fuses, lead sleeves, brass, bronze and copper wire and one battery outfit.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Account, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Until May 2, at the Eastern and Western yards, Schedule 3896—miscellaneous magnet wire. Until April 29, Philadelphia, Pa., Schedule 3906—lighting and power wire. Pensacola, Fla., Schedule 3906—rubber-covered wire. Brooklyn, N. Y., Schedule 3913—miscellaneous communication cable; Schedule 3914—solid braided wire and weatherproof wire. Washington, D. C., Schedule 3916—electrical wire. Brooklyn, N. Y., Mare Island, Cal., Portsmouth, N. H., and Philadelphia, Pa., Schedule 3915—hard-drawn phosphor copper, manganese bronze, commercial and naval rolled brass. Until April 25 South Brooklyn, N. Y., Schedule 3924—miscellaneous steel conduit pipe. Until April 15, Washington, D. C., Schedule 7912½—miscellaneous single-conductor wire. Applications for proposal blanks should designate the schedule desired by number.

North Central States

BAY CITY, MICH.—The Electric Light Department is contemplating the purchase of three switchboard panels and feeder, 300 Cutter suspension incandescent lamps, 500 Duncan meters and overhead-line material for normal requirements. C. J. De Bates is manager.

DETROIT, MICH.—The Detroit Edison Company is reported to be contemplating an addition to its Delray power plant, increasing the output by 30,000 kw.

DETROIT, MICH.—Plans have been announced by the General Motors Corporation for extensions of its plants in various parts of the country to be completed during the present year, involving an expenditure of more than $37,398,000, the distribution to be as follows: Detroit, $12,650,000; Flint, $6,715,000; Pontiac, $2,150,000; Lansing, $2,450,000; Saginaw, $2,427,000; Toledo, Ohio, $543,000; St. Louis, Mo., $4,135,000; Janesville, Wis., $4,500,000; Bristol, Conn., $1,978,000, and Muncie, Ind., $800,000. In the allotment to Detroit is included an item of more than $6,000,000 for a fifteen-story office building. In addition to the amount to be expended in the United States the company is planning to erect a new plant in Walkerville, Ont., Can., where a new plant for the Cadillac Motor Car Company division will be erected.

TIPTOP, MICH.—The installation of an electric lighting system in Tiptop is under consideration. Electricity will be obtained from Clinton.

BERLIN HEIGHTS, OHIO.—The local electric plant and substation of the Lake Shore Electric Railway Company was recently destroyed by fire, causing a loss of about $15,000.

COLUMBUS, OHIO.—The City Council has passed an ordinance authorizing the purchase of 30,000 lb. of copper for the municipal electric light plant.

JACKSONVILLE, OHIO.—The Jacksonville Railway & Light Company has received authority from the Public Utilities Commission to issue $125,000 in capital stock.

NORWALK, OHIO.—Bids, it is understood, will soon be asked by the city officials for a 500-kw. generator and condensers for the municipal electric light plant.

OXFORD, OHIO.—Bids will be received in the near future for the installation of electrically driven pumps. The cost of the work is estimated at about $40,000 and will include the erection of 1 mile of high-tension transmission line and a 200,000-gal. elevated tank and installation of pumps. L. A. Boulay, Nicholas Building, Toledo, is engineer.

PERRYSBURG, OHIO.—The Council has engaged F. H. Froelick of the Froelick & Emery Engineering Company of Toledo to prepare plans and estimate of cost of the installation of an ornamental street-lighting system in the business section.

TIFFIN, OHIO.—The Central Power Company of Tiffin is considering extending its electric transmission lines from Shelby to Bucyrus, connecting with Crestline and Galion. The company is seeking a contract to furnish electrical service in Bucyrus.

WELLSVILLE, OHIO.—A power plant will be built in connection with the new yards and car shops of the Pennsylvania Lines West, now under construction at Wellsville. The cost of the entire project is estimated at about $1,000,000.

LOUISVILLE, KY.—Bids will be received at the U. S. Engineer Office, Louisville, until April 30 for furnishing accumulators for lock No. 41 and operating machinery for lock No. 43, Ohio River.

EDWARDSPORT, IND.—The Public Service Commission has granted the Indiana Power & Water Company permission to issue $160,000 in capital stock and $340,000 in bonds, the proceeds to be used for extensions and improvements.

GOSHEN, IND.—The Hawks Electric Company of Goshen has petitioned the Public Service Commission for permission to issue $125,000 in bonds, the proceeds to be used to finance improvements and to make extensions to its plant.

INDIANAPOLIS, IND.—Residents in Indianapolis Heights and Rockville Gardens have petitioned the Merchants' Heat & Light Company to supply electrical service in those districts.

PREBLE, IND.—The Preble Light & Power Company has petitioned the Public Service Commission for permission to issue $8,000 in capital stock, the proceeds to be used for extensions.

CHICAGO, ILL.—Bids will be received by the clerk of the Sanitary District of Chicago, 910 South Michigan Avenue, until April 24, for the Des Plaines River sewage treatment works, including electrical equipment, under Division P, consisting of three vertical shaft-cage induction motors, each of 50 hp.; four horizontal-shaft, slip-ring wound-rotor motors, each of 150 hp.; two horizontal-shaft squirrel-cage induction motors, one 75 hp. and one 30 hp.; four 300-kva. transformers, oil-switch equipment and miscellaneous appurtenances. Division R—Blowers, including six blowers of the horizontal hydro-turbine type. Specifications and forms of proposals may be obtained upon application to the above office upon deposit of $2.50 for each copy. John McGillen is clerk of board.

COLUMBIA, ILL.—Preliminary plans have been adopted by the Mayor and City Council for new equipment for the municipal electric light and power plant, consisting of extension to building, installation of boilers, engine, generator, switchboard, steam specialties, piping, etc., and erection of chimney. Bids for the work will be asked for in about sixty days. Fuller & Beard, Chemical Building, St. Louis, Mo., are engineers.

DECATUR, ILL.—The Central Union Telephone Company, it is reported, is planning to erect a new building at the corner of Church and North Streets, to cost about $280,000, provided the increased rates petitioned for are allowed by the Illinois Public Utilities Commission.

ROCKFORD, ILL.—The Rockford & Interurban Railway Company has installed a transformer at the village of Rockford and will furnish electricity for lamps and motors in that village.

CLEAR LAKE, WIS.—The electric plants at Glenwood City, Downing and Boyceville, owned by the Wisconsin-Minnesota Light & Power Company, have been purchased by the Clear Lake Electric Company. The plants, which are now driven by steam power, will be connected with the power plant at Little Falls on Apple River as soon as high-tension electric transmission lines can be erected.

NORTH FREEDOM, WIS.—The North Freedom Canning Company is planning to install a steam generating plant and a boiler house in connection with its proposed new plant. The cost of the work is estimated at about $50,000.

SHEBOYGAN, WIS.—The Badger State Tanning Company, it is reported, is asking bids for the construction of a new power plant and boiler house, to cost with other improvements about $50,000.

SUPERIOR, WIS.—At an election held recently the proposal to purchase the local electric light, gas and water plants was carried.

HIBBING, MINN.—Bids will be received by the Water and Light Commission until April 22 for the erection of a new power plant in Alice. The old plant will be dismantled, and as much of the machinery as possible will be used in the new station. Holstead & Sullivan of Duluth are architects. Charles Foster is engineer.

RED WING, MINN.—Plans are being considered for the construction of a municipal electric light plant and new distributing system in Red Wing. The cost is estimated at $350,000. L. P. Wolff, Germania Building, St. Paul, is engineer.

WORTHINGTON, MINN.—Plans are under consideration for the installation of a new switchboard and piping in the municipal electric light plant. Bids, it is understood, will be asked for this spring. The Charles L. Pillsbury Company, Metropolitan Building, Minneapolis, is consulting engineer.

DAVENPORT, IOWA.—A new lighting system is being installed at Vender Park. The old arc-lamp system will be replaced with ornamental lamps maintained by underground wires.

DES MOINES, IOWA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until April 21 for conduit and wiring and lighting fixtures in the old United States court house at Des Moines.

KNOXVILLE, IOWA.—The office building and plant of the Marion County Electric Company was recently destroyed by fire, causing a loss of about $13,000.

KANSAS CITY, MO.—Preliminary steps, it is reported, have been taken by the Kansas City Light & Power Company to petition the Public Utilities Commission for an issue of $6,000,000 in bonds. The company, it is said, will erect a new plant.

MANDAN, N. D.—The City Commissioners are considering lighting all the streets in the paved district and some of the connecting streets, a total of seventy-seven blocks, with electricity. The cost is estimated at $38,000. Black & Griffin of Mandan are engineers.

CARTHAGE, S. D.—An election will be held April 15 to vote on the proposal to issue $18,000 for the installation of a municipal electric light plant in Carthage.

Southern States

BENSON, N. C.—Bids will be received by the Mayor and Board of Commissioners of the town of Benson until April 24 for construction of waterworks, electric light plant and sewerage system. The proposed work will consist of deep well and pump, combined water and electric station, 60-kw. and 100-kw. generating units, boilers, pumps and reservoir and about 5 miles of water-pipe lines, about 4 miles of sewers and sewage-disposal plant. No bids on electric distribution system. Copies of plans may be obtained from Gilbert C. White, engineer, Durham, N. C., upon deposit of $10.

MOULTRIE, GA.—Swift & Company of Chicago, Ill., are contemplating the construction of a power house and two additional stories to its local cold-storage building. The cost of the work is estimated at about $150,000.

CHATTANOOGA, TENN.—The capital stock of the Southern Cities Utilities Company has been increased from $50,000 to $2,500,000.

CHATTANOOGA, TENN.—The power station of the Chattanooga Railway & Light Company on the east brow of Lookout Mountain was recently destroyed by fire, causing a loss of about $50,000.

GLOSTER, MISS.—Bonds to the amount of $11,000 have been voted for the installation of new machinery in the municipal electric and water plants, including oil-burning engines.

CHIDESTER, ARK.—The installation of a light and water plant in Chidester is reported under consideration.

Pacific and Mountain States

SEATTLE, WASH.—Work will begin on extensive additions to the municipal light and power system in the near future, preparatory to receiving and distributing the additional energy to be developed at the Cedar River plant and that is expected to be furnished later on by the development of the Skagit project. The work includes the erection of new lines for street lighting and furnishing electricity for lamps and motors in the business and residence districts, equipping the substation at Ballard and the industrial substation on Spokane, and constructing tie lines connecting the different substations. The ultimate plan is to bring the Cedar River current to the Spokane Street substation instead of the station at Seventh and Yesler Avenues, which will become a distributing station with a lower voltage for the main business section. The Spokane Street substation will also connect with the steam plant on Lake Union at 15,000 volts and on to the Lake Washington Canal, where the Skagit substation will be located, with a transmission voltage of 150,000 from the Skagit plant.

PORTLAND, ORE.—Arrangements are being made by the Pacific Power & Light Company to connect its transmission lines with the lines of the Inter-Mountain Power Company at Lind.

PORTLAND, ORE.—The East Side Mill & Lumber Company of Portland is planning to install a cross-arm factory. About 200 hp. additional will be installed. The company now operates a box factory.

PASADENA, CAL.—The City Commission has voted to accept the proposal of the Department of Public Service of the city of Los Angeles to supply electrical energy to the city of Pasadena for a period of fifteen years. The City Council of Los Angeles has approved the ordinance authorizing the execution of a contract providing for the sale of surplus aqueduct electric power to the city of Pasadena. Under the terms of the contract the Pasadena municipal steam-power plant must be kept in readiness for emergency service.

SAN FRANCISCO, CAL.—Steps have been taken by the Board of Works for the installation of danger signals and lamps on safety stations throughout the city.

SAN FRANCISCO, CAL.—Application has been filed by Horace W. Woolley of San Francisco with the State Water Commission for permission to appropriate 600 cu.ft. per second of water of Kings River in Fresno County, a tributary of the Fresno River, for the development of electricity. The proposed plans provide for the construction of a diversion dam, 50 ft. high, 200 ft. long on top and 180 ft. long at bottom, canal 10½ miles long. The equipment will include impulse waterwheels directly connected to electric generators. About 65,000 hp. will be developed. The cost of the project is estimated at about $6,000,000.

OGDEN, UTAH.—The construction of a municipal electric light plant in Ogden is under consideration.

SALT LAKE CITY, UTAH.—Plans are under consideration for the installation of a lighting system along the highway between Salt Lake City and Ogden. Wesley E. King is chairman of the lighting committee.

FLORENCE, ARIZ.—The Senate has passed the bill providing for the erection of an electric transmission line from Sacaton to the State Prison at Florence and for the installation of electrically operated machinery to replace the present steam engine.

FLAGSTAFF, ARIZ.—Plans are under consideration for a large dam at the mouth of Diamond Creek in the Grand Canyon of the Colorado River by the Grand Canyon Power Development and its affiliated corporation, the Hualpai Syndicate of New York. The project includes the construction of dam, installation of a hydroelectric power plant, erection of transmission lines and substations, to cost about $12,000,000. The proposed plant will provide power to operate the trains on 500 miles of the Atchison, Topeka & Santa Fé railway system in Arizona and also supply electricity to many of the cities, towns and mining camps in that section of the state. James McGirand is chief engineer of the company.

BRECKENRIDGE, COL.—Estimates submitted by engineers for the proposed municipal electric lighting system place the cost at $14,000. A bond issue of $25,000 is recommended.

Canada

FORT WILLIAM, ONT.—An extension of the street-railway system to Mission Park is under consideration by the Public Utilities Commission. The cost is estimated at about $68,235.

GUELPH, ONT.—Plans are being prepared for the installation of two electrically driven units, having a combined capacity of 3,024,000 imperial gallons for twenty-four hours, and a booster pump for fire purposes.

DONNACONA, QUE.—The Donnacona Paper Company is reported to be contemplating a hydroelectric project on the Jaques Cartier River, 27 miles from Quebec. The proposed work will include a dam, flume, power house and installation of electric generating equipment. The company recently purchased 183,360 acres of timber land in this section. G. H. P. Gould, Lyons Falls, N. Y., is president.

MONTREAL, QUE.—Plans are being prepared by I. W. Carmichael, architect and engineer, 29 Hospital Street, for the erection of two new telephone exchanges, to cost about $350,000.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing agent, the Panama Canal, Washington, D. C., until April 19, for furnishing steel, iron railing, iron pipe, boiler tubes, copper tubing and pipe, conduit fittings, fiber rod, receptacles, switches, ammeter and voltmeter. Blanks and information relating to this circular (1269) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 606 Common Street, New Orleans, La., and Fort Mason, San Francisco, Cal.

(Issued March 4, 1919)

1,296,194. ELECTRIC ARC FURNACE; Jens L. La Cour, Christiania, Norway. App. filed Nov. 22, 1915. For equalizing sudden changes of pressure a buffer is mounted directly on furnace.

1,296,250. AUTOMATIC TEMPERATURE REGULATOR; Walter Wyss, Arbon, Switzerland. App. filed March 23, 1918. Plurality of furnaces or other sources of heat placed under temperature control of single apparatus.

1,296,262. BURGLAR ALARM; Fred A. Brunel, Hempstead, N. Y. App. filed May 22, 1917. Opening window sash actuates switch to close signal circuit.

1,296,264. VAPOR RECTIFIER; David E. Carpenter, Wilkinsburg, Pa. App. filed June 9, 1914. By assuring plentiful supply of ions at all portions on vapor path, rectifier is readily started.

1,296,270. FIRE ALARM; William M. Dana and Charles C. Palmer, Minneapolis, Minn. App. filed March 4, 1918. Especially adapted for use with telephone systems.

1,296,276. CIRCUIT CLOSER FOR SIGNALS FOR AUTOMOBILES; Moritz B. Fischer, Chicago, Ill. App. filed Jan. 24, 1918. When slowed down or about to stop, notice is given at rear of vehicle.

1,296,287. PHASE-CONVERTING SYSTEM; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Jan. 23, 1915. For railway polyphase induction motors receiving energy from single-phase source of distribution.

1,296,292. SYSTEM OF ELECTRICAL DISTRIBUTION; John W. Jepson, New York, N. Y. App. filed April 17, 1906. General voltage automatically regulated irrespective of generator speed.

1,296,293. ELECTRICAL SYSTEM OF DISTRIBUTION; John W. Jepson, Buffalo, N. Y. App. filed Nov. 27, 1907. Two regulators provided, one for confining generator output and other for regulating voltage.

1,296,305. INK-FED MARKING DEVICE; Jacob F. Mehren, Chicago, Ill. App. filed July 16, 1918. Supply of ink to marker is continuous and sufficient without being excessive, thereby avoiding waste, smearing and blotting, and unsightly results.

1,296,314. CURRENT LIMITER; Kristian Pettersen, Sarpsborg, Norway. App. filed Jan. 25, 1916. Current consumption at different places controlled by same apparatus.

1,296,323. CONVERTIBLE ELECTRIC APPLIANCE RECEIVING BOX; Joseph Sachs, Hartford, Conn. App. filed July 26, 1916. May receive switch, cut-out, meter-testing instrumentalities, etc.

1,296,350. ELECTRIC WELDING SYSTEM; Emerson S. Zuck, Wilkinsburg, Pa. App. filed Oct. 3, 1913. Means provided for starting welding arc and for switching welding tools to main supply circuit when arc has been established.

1,296,358. WELDING ELECTRODE; Benton W. Bowers, Easton, Pa. App. filed June 27, 1918. Has shield and handle to reduce heating to minimum.

1,296,362. LIGHTNING ARRESTER; Stanley C. Bryant, Chicago, Ill. App. filed May 29, 1917. High-tension oscillating currents or charges flowing along line toward signal-controlling device are diverted and dissipated.

1,296,387. BREAD RAISER; Mary E. Harris, Modesto, Cal. App. filed Aug. 16, 1917. Electrically heating receptacle for dough.

1,296,404. FLASHLIGHT; Harry M. Koretzky, New York, N. Y. App. filed May 10, 1918. Contact maintained between central terminal of battery and central contact of lamp without undue pressure.

1,296,408. STORAGE BATTERY; Orville L. Leach, Providence, R. I. App. filed April 24, 1918. Grid is composed of frame with spaced bars extending between and joining top and bottom of frame.

1,296,420. TIMER BRUSH; Earl L. Miller, Overbrook, Kan. App. filed Nov. 17, 1917. Made of resilient nature and has contact point of hard metal to resist wear.

1,296,438. REMINDER CLOCK; Augustus W. South, Chicago, Ill. App. filed Jan. 6, 1915. Attention automatically shows reminder.

1,296,439. MULTIPLE-TURRET TARGET INDICATOR; Elmer A. Sperry, Brooklyn, N. Y. App. filed Aug. 31, 1914. Turret trained quickly on right target and all danger of interference with adjacent turret obviated.

1,296,440. REPEATER SYSTEM FOR GYRO-COMPASSES; Elmer A. Sperry, Brooklyn, N. Y. App. filed June 21, 1911. For reproducing at a distance the readings of a master compass.

Record of Electrical Patents

Notes on United States Patents

1,296,453. PROCESS OF GALVANOPLASTY; Blasius Bart, Providence, R. I. App. filed March 31, 1916. By means of electrochemical steps copies in all sizes, reproducing every feature and detail of the model, may be obtained.

1,296,487. SYSTEM OF SPEED CONTROL FOR INDUCTION MOTORS; Adolphus M. Dudley, Oakmont, Pa. App. filed Oct. 21, 1916. Motor accelerated in smooth, uniform and economical manner up to, through and above synchronism.

1,296,498. PROCESS OF REPRODUCING ARTICLES IN METAL; Antal Fodor, New York, N. Y. App. filed April 17, 1917. Artistic figures of metal produced in economical fashion.

1,296,504. RADIO TELEGRAPHY AND TELEPHONY; John Hays Hammond, Jr., Gloucester, Mass. App. filed Aug. 24, 1912. Methods for periodically varying amplitude of transmitted electric waves.

1,296,523. PROCESS FOR TREATING ORES; Joseph Irving, Bisbee, Ariz. App. filed Jan. 27, 1917. Effects continuous regeneration of reagents.

1,296,558. PROTECTIVE DEVICE FOR ELECTRIC CIRCUITS; Lloyd N. Robinson, Berkeley, Cal. App. filed Nov. 28, 1916. For alternating-current systems employing long-distance transmission circuits.

1,296,575. APPARATUS FOR CARRYING OUT PROCESSES OF WINNING METALS; Victor M. Weaver, Harrisburg, Pa. App. filed Aug. 22, 1914. Reagents or their constituents collected and, if desired, reused so that continuous process is carried on economically and conveniently.

1,296,587. INSULATOR; William Schaake, Pittsburgh, Pa. App. filed April 5, 1917. Cable-securing means enable clamps to swing into alignment with supported conductor.

(Issued March 11, 1919)

14,610 (reissue). CONTROL SYSTEM; Karl A. Simmon, Edgewood Park, Pa. App. filed Dec. 31, 1918. Minimizes burning of contact members of electric railway motor controller.

1,296,604. SWITCH-OPERATING MECHANISM; Arthur H. Adams, Sparkill, N. Y. App. filed March 31, 1916. Electrically operated clutch mechanisms for coupling selector switch to power shaft.

1,296,613. TELEGRAPH SYSTEM; John H. Bell, East Orange, N. J. App. filed Aug. 1, 1917. For indicating variation of electrical characteristics in circuits of duplex telegraph systems.

1,296,616. ELECTRICAL MEASURING INSTRUMENT; Clarence A. Boddie, Pittsburgh, Pa. App. filed Sept. 21, 1915. Kelvin balance interposed between current winding and circuit of wattmeter.

1,296,617. TELEPHONE SYSTEM; William G. Britten, Fanwood, N. J. App. filed July 29, 1916. Flexible paging or announcing systems.

1,296,620. ALTERNATING-CURRENT MOTOR; James Burke, Erie, Pa. App. filed Feb. 7, 1917. Single-phase commutator type without sparking at brushes.

1,296,634. ELECTROCHEMICAL MOTOR; Georges A. De Guire, Montreal, Quebec, Can. App. filed May 9, 1916. Speed of core's reciprocating motion controlled by bell.

1,296,635. ELECTROMECHANICAL MOTOR; Georges A. De Guire, Montreal, Quebec, Can. App. filed April 30, 1917. Electrically operated mechanical device automatically actuates control switch.

1,296,636. TRIP SWITCH; Georges A. De Guire, Montreal, Quebec, Can. App. filed April 30, 1917. Switch is normally closed by gravity.

1,296,651. METHOD OF SECURING TOGETHER HEAVY STEEL PLATES; James H. Gravell, Brooklyn, N. Y. App. filed July 26, 1918. Combination riveting and spot-welding process.

1,296,677. TELEPHONE-EXCHANGE SYSTEM; Eric R. Lundius, Brooklyn, N. Y. App. filed May 3, 1918. Answering receiver not connected with talking circuit until after ringing current has been disconnected.

1,296,679. TELEPHONE SYSTEM; James L. McQuarrie, Montclair, N. J. App. filed Aug. 2, 1917. Ringing current repeated at intervals if not answered.

1,296,680. TELEPHONE EXCHANGE; James L. McQuarrie, Montclair, N. J. App. filed Nov. 26, 1917. Flexible group of step-by-step switches.

1,296,683. TELEPHONE TRANSMITTER; Joseph P. Maxfield, Maplewood, N. J. App. filed Jan. 3, 1916. Microphonic diaphragm.

1,296,687. MEANS FOR SIGNALING FROM CAPTIVE BALLOONS; Harold W. Nichols, Maplewood, N. J. App. filed Feb. 16, 1917. By means of balloon cable.

1,296,693. CALCULATING MACHINE; Arthur Pentecost, East Orange, N. J. App. filed Feb. 28, 1916. Power circuit opened if machine is not operated during certain interval of time.

1,296,698. MANUALLY OPERABLE CONTROLLING DEVICE FOR ELECTRIC MOTORS; Cleveland Redfield, Ogden, Utah. App. filed Aug. 10, 1916. Decrease in inductance may be made approximately proportional to decrease in load demand.

1,296,700. PRIMARY BATTERY; Otto E. Ruhoff, Madison, Wis. App. filed June 9, 1917.

1,296,727. TABULATING DEVICE; John E. Wright, New York, N. Y. App. filed May 14, 1918. Perforated cards passed under series of contacts.

1,296,729. CIRCUIT CONTROLLER; Paul H. Zimmer, Milwaukee, Wis. App. filed Nov. 20, 1916. Movable contacts insure firm engagement with coöperating contacts.

1,296,731. INSULATING SLEEVE; Albert Aichele, Baden, Switzerland. App. filed Oct. 4, 1916. Concave surface stepped instead of a smooth surface.

1,296,740. TELEGRAPH SYSTEM; John H. Bell, South Orange, N. J. App. filed April 22, 1918. Signaling current is effective with a line conductor only at beginning and end of impulse intervals.

1,296,748. TROLLEY-WIRE HANGER; Glenn H. Bolus and William A. Darrah, Mansfield, Ohio. App. filed May 2, 1917. Hanger readily adjusted when installed.

1,296,752. ELECTRIC INDUCTION FURNACE; Oscar Brophy, Philadelphia, Pa. App. filed June 12, 1918. Primary and secondary elements mounted to insure brisk circulation of molten metal.

1,296,774. MAGNETO CUT-OFF SWITCH; Nelson W. Dalton, Buffalo, N. Y. App. filed Nov. 11, 1916. For testing operation of dual magneto systems in aircraft motors.

1,296,780. ELECTRIC WELDING; Frank L. Dyer, Montclair, N. J. App. filed Dec. 20, 1917. For joining thin iron and steel sheets without affecting metal.

1,296,801. ELECTRICAL SWITCH DEVICE; William F. Hessel, New York, N. Y. App. filed Aug. 8, 1917. Used with plurality of extension lights for shipbuilding purposes.

1,296,808. INCLOSED FUSE; George McD. Johns, St. Louis, Mo. App. filed Jan. 2, 1917. Difficult to use fusible-element of wrong size.

1,296,811. SWITCH BOX; Claude A. Keller, Cleveland, Ohio. App. filed March 7, 1916. Easily made without use of screws.

1,296,813. CORE-LOSS TESTER; George A. Kelsall, New York, N. Y. App. filed June 17, 1916. Standard primary coil readily linked to core to be tested.

1,296,829. TROLLEY-WIRE HANGER; James A. McIntosh, Lafayette, Ind. App. filed Feb. 2, 1918. Clenched to trolley wire.

1,296,860. TROLLEY-WIRE HOLDER; Herman Schutte, Wilkinsburg, Pa. App. filed April 25, 1918. Automatically locked when in use.

1,296,862. CLAMPING MECHANISM; Willard T. Sears, Philadelphia, Pa. App. filed Sept. 12, 1916. Operating element rotates clamping device.

1,296,896. ELECTRIC FURNACE AND METHOD OF MELTING METALS AND SMELTING ORES; Parvin Wright and Ivan B. Wright, Seattle, Wash. App. filed Nov. 21, 1917. Magnetizable metals fed magnetically into arc furnace.

1,296,932. MAGNETO TESTER; Daniel C. Dodge, Boone, Iowa. App. filed March 22, 1918. Strength of automobile magneto magnet directly indicated.

1,296,941. BRUSH CONNECTOR FOR ELECTROPLATING GENERATORS; John J. Flynn, Irvington, N. J. App. filed Jan. 29, 1916. Permits use of different voltages.

1,296,952. ELECTRIC CONDUIT; William Handley, Providence, R. I. App. filed Jan. 13, 1915. Used also as conductor.

1,296,961. BATTERY MUD EXTRACTING DEVICE; Samuel D. Irwin, Floydada, Tex. App. filed July 1, 1918. Mud removed without disassembling of battery.

1,296,963. SPARK COIL; George A. Jacobs, Cleveland, Ohio. App. filed Jan. 31, 1917. Using fine insulated iron wire for secondary winding enables iron to be employed in the magnetic circuit.

1,296,976. ELECTRICALLY CONTROLLED APPARATUS; George I. Leonard, Chicago, Ill. App. filed Jan. 29, 1917. For refrigerating purposes.

1,296,988. METHOD OF OPERATION FOR THE SEPARATION OF LIQUIDS; Charles W. McKibben, Houston, Tex. App. filed Aug. 17, 1918. Series of separating devices connected together in electric circuit.

1,296,999. PANELBOARD CONSTRUCTION; Edwin A. Olley, Syracuse, N. Y. App. filed Aug. 6, 1915. Width made small.

1,297,000. PROCESS OF MAKING DUCTILE BODIES OF REFRACTORY MATERIALS; Peter Orange, New York, N. Y. App. filed Feb. 5, 1917. Produced by volatilization of electrodes in electric arc.

1,297,012. ELECTRIC SWITCH; Joseph Sachs, Hartford, Conn. App. filed Oct. 14, 1915. Access to casing prevented when switching member is live.

1,297,087. SPARK-PLUG TESTER; James W. Burton, Welch, W. Va. App. filed Sept. 30, 1916. Applied to standard spark plug without removing it.

1,297,096. STARTING DIRECT-CURRENT MOTORS; Henry W. Chadbourne and Arthur F. Knight, Schenectady, N. Y. App. filed April 11, 1917. Steps necessary to starting a motor performed in proper sequence.

1,297,100. TELEPHONE-EXCHANGE SYSTEM; Henry Clausen, Mount Vernon, N. Y. App. filed March 18, 1915. Connection of exchange connecting circuit with calling line causes operation of signaling means at exchange.

1,297,102. IGNITION DEVICE FOR INTERNAL-COMBUSTION ENGINES; Mortimer A. Codd, Lambeth, Eng. App. filed Sept. 7, 1916. Coil, low-tension contact breaker and distributer are one unit.

1,297,109. ELECTRIC BRAKE FOR AUTOS; Charles W. Cunningham, Decatur, Ill. App. filed Aug. 8, 1918. Operated by push-button on steering mechanism.

1,297,120. MOTOR-CONTROL SYSTEM; John Eaton, Schenectady, N. Y. App. filed Feb. 7, 1914. Motor may be quickly stopped and direction of rotation reversed.

1,297,121. MOTOR CONTROL; John Eaton, Schenectady, N. Y. App. filed Nov. 9, 1916. Plurality of mechanically independent electric motors started and stopped simultaneously.

1,297,126. MAGNET CORE; Gustaf W. Elmen, Bogota, N. J. App. filed April 2, 1918. Has specific gravity of approximately 7.

1,297,127. MAGNET CORE; Gustaf W. Elmen, Bogota, N. J. App. filed April 2, 1918. See above patent.

1,297,130. SYSTEM OF SHIP PROPULSION; William L. R. Emmet, Schenectady, N. Y. App. filed Dec. 12, 1916. Operates economically on all speeds.

1,297,133. CLAMP, BINDING POST OR THE LIKE; Charles D. Filkins, Schenectady, N. Y. For spiral windings of radio oscillation transformers.

1,297,146. CONTINUOUS-CONTACT REEL; John L. Gleason, Boston, Mass. App. filed Oct. 19, 1917. For portable electrically driven machinery.

1,297,149. ELECTRIC FURNACE; Albert E. Greene, Seattle, Wash. App. filed Oct. 12, 1917. Shell has rotative movement to facilitate extracting portions or all of its contents.

1,297,157. ELECTROLYTIC CELL; John Harris, Lakewood, Ohio. App. filed Sept. 29, 1917. For generation of hydrogen and oxygen from water.

1,297,159. ELECTRIC SEPARATOR; Carl William J. Hedberg, New Britain, Conn. App. filed Feb. 7, 1918. Particles of a mixture sifted by action of electrostatic charges.

1,297,161. TRANSFORMER; Allan B. Hendricks, Jr., Pittsfield, Mass. App. filed May 20, 1914. Shell-type core is uncased.

1,297,174. ELECTRIC SWITCH MECHANISM; Ernest H. Jacobs, Schenectady, N. Y. App. filed April 29, 1915. With relay tripping device.

1,297,179. SEPARABLE PLUG; John J. Kenney, Pittsburgh, Pa. App. filed Aug. 7, 1916. Easily disengaged by pull on cap without injury to plug or cord.

1,297,185. ELECTRIC STORAGE BATTERY; William Knoblock, Philadelphia, Pa. App. filed May 18, 1918. Pillar strap insures perfect contact of electrodes.

1,297,188. SYSTEM FOR AMPLIFYING VARIABLE CURRENTS; Irving Langmuir, Schenectady, N. Y. App. filed Oct. 29, 1913. Means for securing selectivity in detecting signals.

1,297,236. MAGNETIC-CLUTCH-CONTROLLING METHOD AND APPARATUS; Karl E. Peiller, Hartford, Conn. App. filed Dec. 16, 1915. Energy supplied to magnet is varied to adapt its seizing and holding powers to required functions.

1,297,251. TELEPHONE SYSTEM; Homer J. Roberts, Evanston, Ill. App. filed June 3, 1901. Calling subscriber automatically connects his line with idle trunk line leading to manual switchboard.

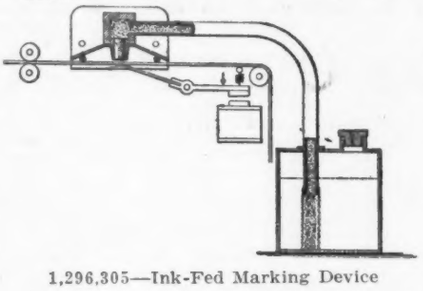
1,297,268. FIRE-ALARM INDICATOR; Fred M. Stacy and William F. Woods, Portsmouth, N. H. App. filed May 18, 1917. Hinged drops successively numbered are released by magnetically operated mechanism.

1,297,281. HEATING DEVICE; Mary Wheeler and Edith M. Bates, Los Angeles, Cal. App. filed June 18, 1918. One of the heating-coil supporting frames is a support for the cooking pans.

1,297,297. CEMENT-MAKING PROCESS; Woolsey McA. Johnson, Hartford, Conn. App. filed Feb. 2, 1915. Combination fuel and electric process.

(Issued March 18, 1919)

1,297,309. MANUFACTURE OF VACUUM-TUBE DEVICES; Harold D. Arnold, East Orange, N. J. App. filed Nov. 18, 1915. Heat applied to exterior of vessel during evacuation.



1,296,305—Ink-Fed Marking Device

1,297,313. APPARATUS FOR DIRECTED WIRELESS TELEGRAPHY AND TELEPHONY; Ettore Bellini, Enghien les Bains, France. App. filed June 19, 1915. Operated without turning antennas.

1,297,326. ELECTRIC AND THERMOSTATIC INDICATOR AND ALARM; Lars J. Dahl and Albert E. Allen, Alpha, Minn. App. filed March 29, 1917. Circuit closed through adjustable contacts.

1,297,348. ELECTRIC SWITCH; George H. Hart, Hartford, Conn. App. filed Oct. 2, 1918. Spindle of rotary snap switch for actuating catch is relieved of driving strain.

1,297,358. TELEPHONE-EXCHANGE SYSTEM; Charles W. Keckler, Newark, N. J. App. filed Jan. 2, 1918. Telephone lines of different characters terminating at central office interconnected by universal link circuit.

1,297,378. APPARATUS FOR DEHYDRATING OIL; Fred W. McNear, Menlo Park, Cal. App. filed Oct. 2, 1916. Separation continuously and completely effected, thus obviating settling tanks for water.

1,297,381. RAIL BOND AND METHOD OF MANUFACTURING IT; George A. Mead, Mansfield, Ohio. App. filed June 2, 1916. Strength of union between welding metal and bond terminal varies greatly.

1,297,382. RAIL BOND; George A. Mead, Mansfield, Ohio. App. filed June 21, 1916. Contains small amount of metal, making it unattractive to thieves.

1,297,383. RAIL BOND; George A. Mead, Mansfield, Ohio. App. filed June 2, 1916. Welded to rail by oxy-acetylene or electric arc.

1,297,387. FUME ABSORBER FOR ELECTRIC LAMPS; William R. Mott, Lakewood, Ohio. App. filed Jan. 27, 1917. Fused boric oxide combines with glass etching fluoride to form hydrofluoboric acid.

1,297,393. PRODUCTION OF CHEMICAL CHANGES BY OSCILLATORY DISCHARGE; Edwin F. Northrup, Princeton, N. J. App. filed July 13, 1917. May be used for either chemical synthesis or chemical dissolution.

1,297,395. APPARATUS FOR MANUFACTURING CHLORATES BY AN ELECTROLYTIC PROCESS; Takeo Oiwa, Toyotama Gun, Tokyo Fu, Japan. App. filed July 23, 1918.

1,297,422. ELECTROPNEUMATIC BRAKE; Walter V. Turner, Wilkinsburg, Pa. App. filed March 29, 1917. Generator controlled by fluid under pressure from brake system effects transmission of braking action throughout train.

1,297,432. FILM SOCKET; Herman H. Ashinger, South Bend, Ind. App. filed Feb. 25, 1918. Holding element for film stands away from inner end of socket for accessibility.

1,297,472. RESISTANCE UNIT; Lee P. Hynes, Chicago, Ill. App. filed May 7, 1915. Safe to employ in exposed place.

1,297,487. GALVANIC BATTERY; Charles W. Norton, West Orange, N. J. App. filed Sept. 25, 1916. Necessity of employing bottom insulator within cell container for battery elements is obviated.

1,297,490. TELEPHONE-MOUTHPIECE ATTACHMENT; Howard A. Post, Winfield, Kan. App. filed Feb. 28, 1918. Removable sanitary paper interposed between lips of speaker and mouthpiece.

1,297,511. ELECTROPNEUMATIC BRAKE; Walter V. Turner, Wilkinsburg, Pa. App. filed April 17, 1917. Release of brakes prevented so long as emergency magnet valves are open.

1,297,514. ELECTROFLUID PRESSURE BRAKE; Walter V. Turner, Wilkinsburg, Pa. App. filed Sept. 27, 1917. Braking power varied by increasing or diminishing current flow to brake controlling magnets.

1,297,570. APPARATUS FOR HOT RIVETING; George A. E. Jones, Beverly, Mass. App. filed March 13, 1918. Rivet may be quickly heated by an easily removed electrode.

1,297,608. GUARD FOR ELECTRIC LIGHT CONNECTIONS; Aubrey J. Tidball, Duluth, Minn. App. filed July 20, 1918. Protects flexible cord from wear.

1,297,614. PROCESS FOR JOINING UP ELECTRIC AND OTHER WIRES; Jacob H. van Viersen, The Hague, Netherlands. App. filed Sept. 11, 1917. Small metal junction tube used for covering junction.

1,297,641. ELECTRIC FURNACE FOR SMELTING ORES; Albert E. Bookwalter, Cœur d' Alene, Idaho. App. filed April 26, 1917. Ores are calcined to melting heat and then fused by electric means.

1,297,653. DRY BATTERY; Charles F. Burgess, Madison, Wis. App. filed May 21, 1917. Flashlight bulb attached to cell.

1,297,654. BATTERY HAND LAMP; Charles F. Burgess, Madison, Wis. App. filed May 21, 1917. Considerable reduction in weight of flashlight.

1,297,655. HAND LAMP; Charles F. Burgess, Madison, Wis. App. filed May 21, 1917. Lamp support may be attached to battery end.

1,297,656. BATTERY HAND LAMP; Charles F. Burgess, Madison, Wis. App. filed May 21, 1917. Support may be reversed to protect the lamp.

1,297,657. BATTERY HAND LAMP; Charles F. Burgess, Madison, Wis. App. filed May 26, 1917. See above patents.

1,297,672. WINDOW LOCK AND ALARM; Isidore Fier, Brooklyn, N. Y. App. filed Oct. 23, 1917. Pressure on window sash operates alarm.

1,297,687. PNEUMATIC SWITCH; William E. Haskell, Brattleboro, Vt. App. filed Jan. 22, 1917. Pneumatic switch closes electric circuit.

1,197,744. RESISTANCE MATERIAL; George T. Southgate, Brooklyn, N. Y. App. filed April 19, 1917. Cuprous sulphide used as resistance material in lightning arrester.

1,297,768. ELECTRIC LIGHTING SYSTEM FOR AUTOMOBILES; John H. Wilton, United States Army. App. filed Feb. 13, 1918. Includes alternate sources of current.

1,297,772. CONCEALED-TERMINAL RECEPTACLE; Harry C. Adam, St. Louis, Mo. App. filed July 27, 1917. Reduces the liability of short circuits during installation.

1,297,774. TELEPHONE ATTACHMENT; Moses T. Allan, Neville, Saskatchewan, Canada. App. filed April 12, 1918. Provides alarm whereby eavesdropping may be detected and identified.

1,297,780. SYSTEM OF DISTRIBUTION; David Basch, Schenectady, N. Y. App. filed May 3, 1917. Circuit breakers used to control feeders on systems of high generator rating.